May 1958

Agriculture

Volume LXV Number 2

Television teaches

Published for the Ministry of Agriculture, Fisheries and Food
by Her Majesty's Stationery Office

NINEPENCE MONTHLY

Agriculture

Volume LXV Number 2 May 1958

EDITORIAL OFFICES
THE MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
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Farmers' Attitudes to Borrowing Money

G. C. McFarlane, B.Ec.(Sydney)
University of Bristol, Newton Abbot

Most of the farmers interviewed in a Devon survey last year preferred buying out of savings rather than borrowing. Given managerial ability, however, judicious borrowing can increase farm incomes appreciably.

Efficiency in the use of capital is undoubtedly one of the key factors in successful farm management. Without adequate capital it is impossible to make the best use of available land, labour and equipment. On the other hand, it does not necessarily follow that abundant capital will ensure a high farm income: success depends also upon the skill with which capital is combined with other resources. In recent years there has been some concern about the shortage of capital on many farms in the United Kingdom, and official recognition of the problem has been given in Government policy and legislation since 1946.

The problem of inadequate capital has emerged because the time has come for large-scale modernization of buildings and equipment in order to improve the efficiency of agricultural production. Also, health regulations and price incentives designed to raise the quality of milk have induced farmers to improve their dairy buildings.

Increased competition from other food-producing countries and rising wages have forced farmers to consider methods of reducing unit costs of production, and in many cases major improvements to buildings and other facilities are called for.

Many farmers have already seen the need for this work and have carried out improvements without waiting for Government assistance. The Government's measures will undoubtedly help others, but it will be a pity if farmers restrict their investment to projects for which grant-aid can be anticipated. Each farmer should consider the condition of his buildings and equipment and plan to make capital investment when and where it is needed. This has, of course, always been necessary, but the current trend for greater dependence on labour-saving equipment has increased the capital needs of farms and given greater significance to the careful management of finances.

The response of farmers to the present need for greater investment will probably follow much the same pattern as their response to other innovations: a few will lead the way and others will follow more cautiously. At the moment, however, efficient farmers will probably have an advantage over the rest in that they will more readily be able to find the capital to invest; as a result of higher incomes, their savings will be greater and they will probably have less difficulty in borrowing money.

The farmer who has had low profits for a number of years will not have been able to save much money for investment and will probably also have difficulty in borrowing. It will seem to him that his income will be chronically low unless something unexpected happens to improve his capital position.

Saving preferred to borrowing

To throw some light on farmers' attitudes to this question of borrowing, a survey was recently carried out among owner-occupier farmers in Devon.* Of fifty-three farmers interviewed, a high proportion indicated that they prefer to rely on their own profits and savings rather than resort to borrowing. It was found, for example, that about 86 per cent of those planning to improve farm buildings intended to finance the work from their own savings. The fact that very few would borrow is possibly partly due to current restrictions on lending, but only one-third said they had borrowed money in recent years for improvements to buildings.

Similarly, about one-third said they would like to have more machinery, but only one-tenth were planning to buy it this year. The items most commonly mentioned as being needed were relative innovations which would improve the efficiency of operations; for example, manure spreaders, hay balers and hedge trimmers. The main reason given for deferring the purchase of these was lack of money. In most cases, credit could have been obtained or the required amount of money borrowed, but the farmers concerned preferred to wait until they had saved the money.

The extent to which farmers borrow for investment in improvements seems to be associated with their general attitude to farming. While some aim at maximum profits, others are more concerned with security and stability of income. Many farms have been passed from one generation to the next and the present owners are not faced with any serious financial difficulties. About a third of the farmers interviewed had inherited their properties; another third had occupied their farms for over twenty years, and they presumably had already carried out a number of major improvements.

Where owner-occupiers have paid for their farms and are earning a comfortable living, they are often content with a modest income and are not very interested in changes designed to increase profits. They realize there is scope for higher income by intensifying the system of farming, but they are unwilling to borrow for such purposes. They prefer to make some improvements each year out of savings rather than take the additional risk and responsibility associated with borrowing.

Credit-shyness

Further evidence of this independence of borrowed money can be seen from the schedule of overdraft limits given in Table 1. Almost two-thirds of the Devon farmers had no arrangements for bank overdrafts, and another sixth had overdraft facilities for £1,000 or less. These figures slightly understate the extent to which bank credit is used, because it is fairly common for farmers to overdraw their accounts for small seasonal requirements without making a formal overdraft arrangement. Such drawings are, however, usually small amounts which are repaid quickly.

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* Some Observations on Farmers' Attitudes to Finance and Investment. G. C. McFarlane. *University of Bristol, Newton Abbot, Report No. 102,* November 1957.

Table 1

Bank Overdraft Limits on Farms Surveyed

Overdrafts arranged from banks	Farms in group	
£	*No.*	*per cent*
Nil	34	64
0–1,000	8	15
1,001–2,000	5	9
2,001–3,000	1	2
3,001–4,000	2	4
4,001–5,000	3	6

Farmers' attitudes to borrowing are also influenced by two other factors: the interest rate and the need to have reserves to meet fluctuations in income. Although few of the farmers interviewed regard the interest rate as a serious obstacle to borrowing, they do try to reduce their dependence on borrowed money when the interest rate is high. As regards the need for cash reserves, it is clear that the more dependent a farmer is on borrowed money, the more difficult will be his position if his income falls.

It is also relevant to consider the extent to which farmers are prepared to use commercial credit to help finance their operations. The Devon farmers interviewed were asked about their normal methods of paying for machinery, motor vehicles, livestock, feed, seed, fertilizer, fuel and household supplies. As can be seen from Table 2, over 80 per cent said they normally paid fairly promptly for their purchases. Household supplies are nearly always paid for weekly, and 84 per cent pay cash for livestock. Only 12 per cent buy farm machinery or motor vehicles under time-payment systems, the majority preferring to pay cash on delivery or within an agreed (short) time. Sixty-one per cent said that for motor vehicles they normally paid cash on delivery.

The fact that credit is not used extensively on the farms visited does not imply that it is difficult to obtain. On the contrary, practically all farmers said they would have no difficulty in obtaining credit if they wanted it. Farm

Table 2

Methods of Paying for Certain Farm Requisites on 53 Devon Farms

Item	Cash on delivery	Within discount period (usually one month)	Over longer period or by hire purchase	Total
	per cent	*per cent*	*per cent*	*per cent*
Machinery	42	46	12	100
Motor cars	61	27	12	100
Livestock	84	11	5	100
Feed	Nil	82	18	100
Seed	Nil	80	20*	100
Fertilizer	Nil	85	15*	100
Fuel	39	53	8	100
Household supplies	94	6	Nil	100

* Includes 4 per cent where farmers consigned their wool to merchants and settled their accounts when the wool was sold.

machinery firms commonly allow payments to be delayed for two or three months. Also, there is usually little difficulty in deferring payments for feed, seed and fertilizer, but 80–85 per cent of those interviewed endeavour to pay for these items monthly to gain the benefit of discounts. Even where accounts are paid monthly, farmers sometimes benefit through firms being a month or so in arrears with their accounts.

A case of wise borrowing

Although the survey in Devon revealed a high degree of financial independence, there are some farmers who rely heavily on borrowed money. Those whose incomes are too low to permit saving for future investment have either to borrow or be content with a low income. The following brief history of one of the farms looked at provides an interesting example of the results achieved when borrowing is chosen as a way out of this dilemma.

A young farmer bought a 70-acre property in 1949, and immediately set out to develop an intensive system of farming with dairy cattle, sheep, grain crops, pigs and poultry. Having little capital, he immediately resorted to borrowing. This enabled him to make quicker progress with his improvement programme, and the bank was willing to make further advances as output increased. Commercial credit was also obtained, but was usually restricted to short-term transactions so that advantage could be taken of trade discounts. Details of the sources and extent of borrowing are given in the following table.

Table 3

Sources of Finance on a Devon Farm, 1949 to 1956

Year (as at 31st December)	Bank overdraft	Private loans	Creditors	Total liabilities
	£	£	£	£
1949	2,015	Nil	126	2,141
1950	2,939	Nil	172	3,111
1951	2,554	1,027	317	3,898
1952	2,467	1,027	514	4,008
1953	3,257	1,027	551	4,835
1954	2,502	3,000	845	6,347
1955	1,968	3,400	1,765	7,133
1956	3,091	5,750	1,794	10,635

Having a good agricultural training, the farmer had little difficulty in carrying out the improvements, and most of the original plans were completed after six years. Gross output increased each year and currently exceeds £10,000 per annum, yielding an annual net farm income of about £2,500. The farmer already has a good equity in the property, and this should improve in subsequent years as he consolidates his position.

His willingness and ability to borrow were essential to the success of the improvement programme. Without adequate capital investment, his knowledge of the technical developments necessary to increase output could not have been applied. It is clear that the level of income would not have risen so quickly, if at all, without borrowing. It should not, however, be concluded that the decisions to incur quite onerous liabilities were easy to make, nor

should it be thought that success followed automatically when the loans and credit were obtained. Clearly, two factors influenced the extent to which he was prepared to enter into debt: first, his *willingness* and, second, his *ability* to borrow. His willingness to borrow could be taken as a measure of his readiness to accept risks and of his confidence in being able to use the money to produce a higher income. His ability to borrow, on the other hand, reflected the confidence lending authorities had in him as a farm manager.

This example highlights the relationship between efficient management and the use of capital in farming. The practice of paying for such work out of savings is doubtless satisfactory for farmers whose incomes are high enough to permit some accumulation of savings but, in other cases, borrowing seems inescapable. Similar results may be achieved on other farms suffering the underlying weakness of under-investment, provided the farmers have the necessary managerial skill and are prepared to accept risks.

Planning for Pheasants

CHARLES COLES

I.C.I. Game Research Station, Fordingbridge, Hants

Pheasants are not difficult or expensive to rear: many a good day's shooting can be had for very little trouble.

FROM time to time employers ask us to run short courses on modern methods of pheasant and partridge rearing—mainly for their gamekeepers, though the shoot owners themselves sometimes attend as well. This year, for the first time, there was a demand for a more comprehensive course on general game conservation for the increasing number of spare-time keepers on the larger farms.

We were none too sure what sort of men would come along, and awaited their arrival with interest. We expected, perhaps, younger editions of those valuable old pensioners who, when we ask a farmer if anyone is available to protect and encourage the wild game crop, are customarily produced as "doing a bit of trapping about the place". But our students included neither rheumy-eyed warreners in velveteens, nor woodmen-trappers with binder-twine garters. They were mostly farm-workers—some young, some middle-aged—whose employers had become keen on shooting and who in turn had volunteered to take on the job of producing a game crop—along with the beef and the barley. Some of them knew a little about the control of pests, others had organized winter-feeding rounds; one or two had reared small numbers of pheasants successfully, and some had tried to rear partridges—mostly unsuccessfully. All were enthusiastic.

To a conserver of game, these are most heartening signs, and it is evident that many farmers now consider game as a worthwhile by-product of the

land, to be husbanded and harvested methodically and not just left to chance like field mushrooms or hazel nuts.

No one is in a stronger position than the farmer to enjoy good shooting. At little or no inconvenience to his cultivations, he can create the right pattern of farm crops for growing and sheltering wild game. He, too, can insist on sensible precautions being taken when poisonous sprays have to be used, and when large blocks of grass or silage crop—and the game nesting therein—are ready for the knife. If the pests on his ground are well controlled, and winter feeding by means of hoppers is attended to once a week, he can expect to give his friends many a good day's shooting throughout the season.

Establishing a breeding stock

In some areas wild pheasants will increase naturally, provided they are given some protection and encouragement, and no useful purpose will be served by restocking. But in other areas it may be necessary, at any rate for the first year or two, to rear and plant out some pheasants, until a good breeding stock has been established. Up to a point, partridges can also be dealt with in this way, but pheasants give a quicker return from straightforward restocking.

If, after the initial seed stock has been turned down, the farmer still requires to rear several hundred pheasants a year, all he has to do is to put out baited pheasant catchers at the end of the shooting season, and trap as many breeding pheasants as he requires. These can be flock-mated, in a rough wire-netting enclosure containing a few bushes and some herbage, or put into poultry laying arks, or into dual-purpose pheasant laying and rearing pens (10 feet × 6 feet × 4 feet) with one cock to every six hens.

Half a dozen such laying units will produce over a thousand pheasant eggs in April and May from pheasants of a game-farm strain such as the old English Blackneck—the original breed imported by the Romans. Wild hybrids—in other words the hardy mongrels of our hedgerows—will lay half this number up to the middle of May, but after release they will lay a clutch of nine eggs or so in the wild.

It is not advisable to store pheasant eggs for more than twelve to fourteen days if being set under broodies, or for longer than one week if going into an incubator, so it may be necessary to catch more hens than the figures above suggest in order to get the eggs over a short period.

The first eggs may be expected towards the end of March, and the peak production will occur between the end of April and the middle of May. Fertility should be about 95 per cent, and from all eggs set 75 per cent live chicks should hatch. Poultry breeders' pellets, plus a very little wheat, and the usual shell-forming material and grit, should be given from March onwards. Fresh herbage in the pens will also be valuable.

If the pens are open-topped, one wing of each pheasant will have to be tied or brailed—a very simple procedure—and, of course, rooks may well steal a number of eggs.

Incidentally, pheasants, whether breeding birds or chicks, should never be penned where poultry or turkeys have recently been folded; they have little or no resistance to most of the common poultry diseases.

Setting and hatching

The third week in April is a good time to set the first batch of pheasant eggs, with another batch following on, say, a fortnight later. Either coops or nest-boxes, placed directly on the ground, can be used for hatching. Although every farmer's wife will be familiar with the daily brooding routine, it is worth mentioning that pheasant eggs should be stored on slightly moist earth or sand in a cool place such as a stone-walled dairy. When steadying the broodies for a few days before they are given their hatching eggs, it is as well to put them on dummy or hard-boiled *pheasant* eggs, rather than large pot eggs: the difference in size can be unsettling.

Among the commonest reasons why fertile eggs do not hatch well—apart from poor or badly-fed breeding stock—are frosting, rough handling, dry and overheated storage conditions, staleness, chilling while the broody is off, lack of broody heat while she is on—or its equivalent in the incubator—and incorrect humidity.

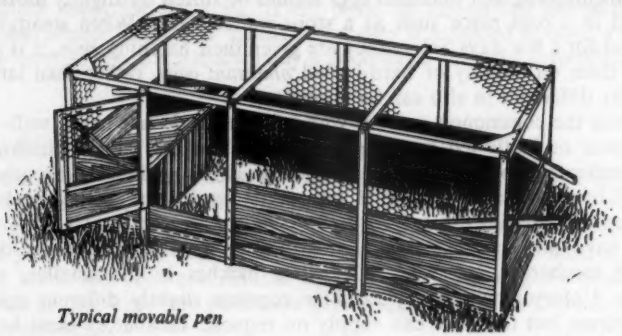
We have not so far had consistently good results with forced-draught cabinet incubators, but we get excellent hatches in the smaller, still-air models. Unfortunately, every machine requires slightly different operating instructions, but these we can supply on request. Incubators must be absolutely level and—if oil-burning—the wicks should be trimmed daily. A steady room temperature of between 50° and 70°F should be maintained, and free ventilation without draughts provides the best room conditions. The thermostat should be adjusted so that the thermometer reads 99¾°F when it is level with the centre of a pheasant egg.

Eggs should be candled for infertiles and early dead germs at 14 days, and turned by hand until the nineteenth day at 8.0 a.m. and 8.0 p.m. The slow turning by hand fulfils another purpose—it allows cooling. We adjust the humidity by watching the development of the air-space at regular intervals—increasing it during the last three days.

The actual rearing of the pheasant chicks is now a simple matter. It is no longer one of the mystic arts of the gamekeeper, but is carried out successfully alike by parsons and poultry girls. Since the development of movable pens, or simple brooders, whichever system is preferred, and balanced crumb feeding, it is usual to rear not less than 80 per cent up to the age of release at about six weeks.

Until the last war nearly all pheasants were reared on free range, the coops being placed in rides mown in fields of grass or clover. A keeper had to be on watch against predators from dawn to dusk, and at nightfall the chicks were shut up in their coops. Despite the keepers, vermin often managed to take a considerable toll, while bad weather caused death from chilling and exposure, and chicks strayed and got lost. During the last ten years the vermin-proof movable pen has become popular and is undoubtedly the saving grace of the unkeepered shoot, or the shoot where the keeper has to rear pheasants and look after his wild game as well: the young pheasants can safely be left while he goes about his other duties. Losses from predatory birds are nil and from ground vermin negligible. The game chicks are to a certain extent protected from the weather, and seem to grow more quickly and evenly. Diseases are isolated. There is no straying from the field, and no

food can be stolen by bird scavengers. About twenty-four pens to the acre allows sufficient moves to fresh ground up to six weeks, and this number of pens should result in the production of about 350 young pheasant poults. The rearing field, which should ideally consist of short grasses and clovers, should be sheltered, well drained, and, if possible, free from depressions and mole-hills. It will be required from about the middle of May onwards for just over eight weeks, if two batches of birds are hatched a fortnight apart.



Typical movable pen

The standard rearing pen is 10 feet × 6 feet × 4 feet, constructed with ½-inch mesh wire netting with a board or light metal sheet 18 inches high all round to give protection from the weather. The coop is fixed to the pen, moving along with it, and the handles act as perches and accustom the birds to roosting out of harm's way. Birds reared in pens are normally taken to the woods at six weeks, with their broodies and coops, but without the pens.

Brooder rearing

Brooders are also an excellent method of producing pheasants cheaply and with a minimum of labour, and more and more farmers are using them every year. We have experimented with small outdoor poultry brooders (100-chick capacity) heated by electricity, paraffin and Calor gas, and we have also carried out trials with large brooder houses and outdoor grass runs capable of producing 2,000 pheasants or more. Although all types of brooder heat appear to be satisfactory, if electricity is available we favour infra-red dull-emitter heaters, which can be bought for between £3 and £4.

The brooder rearing is done in three stages. Up to three weeks the chicks use a heated brooder and grass runs. For the next two weeks the brooder-house birds live in a separate run without heat, where they are "hardened off", their only protection being a rain shelter, into which they have to be driven at night and during violent thunderstorms. In the small units we merely turn off the heat when the weather permits, moving the hut and the run to fresh grass at regular intervals. At five weeks, all the pheasants are taken to release pens in the woods, each pen holding about one hundred birds, and here they are held until they are eight weeks old. They are then liberated in batches, some of their food containers and water fountains being put outside the pens. A little hand-feeding of grain is also started at the side of the rides.

Occasionally in brooders, as in some of the very small movable runs, feather picking will break out. In the case of the runs, the best way to prevent it is to see they are moved to fresh ground at regular intervals. The same applies to brooder-reared birds as long as they are on grass. When they are taken to the woods, their release pens should contain plenty of bushes and fresh-growing greenstuff—to provide "playground facilities" and safe cover from any would-be attackers. If feather picking should develop, it is very easily dealt with by debeaking. The tip of the upper mandible should be removed and cauterized by means of an ordinary poultry debeaker. Although this operation can be carried out on chicks eight days old, we have never actually found it necessary to debeak before the eighteenth day. In time the beak grows again quite satisfactorily.

Making sure of the shoot

The feeding of pheasants is foolproof and inexpensive—costing less than a shilling up to the time the birds are released. In Roman times the chicks were given wine-sprinkled barley meal, powdered locusts, wheat and ants' eggs! And in our own day and age, until recently, the keepers would prepare a steaming cauldron of biscuit meal, minced rabbit, mutton greaves, spices, fowls' eggs, barley meal—sometimes with maggots as a savoury. Today the food consists of balanced crumbs of about 24 per cent protein, with the addition of some wheat at about three weeks of age. As the birds grow, the quality of the greenstuff in the pen becomes important. Fresh water should be before them at all times.

The inclusion of antibiotics and anti-coccidiosis drugs in the diet is still a controversial matter. When birds are reared under normal healthy outdoor conditions on good quality foods, we doubt whether antibiotics are of any value. Our experience so far with drugs such as nitrofurazone suggests that, unless the birds are likely to get coccidiosis or are being reared under unduly intensive conditions, it is better not to use a preventive drug, but to be ready with sulphamezathine treatment should the disease break out.

On the whole, the average rearing field of today is remarkably trouble-free. When all the birds are in covert it will, of course, be necessary to protect them from their natural enemies, and feed them carefully—not necessarily lavishly—to prevent the neighbours from seeing too much of the feathered fruits of one's labours. But this does not take up much time.

As to whether a modest programme of game conservation is worth while or not, there has always seemed to us to be little difference between a potentially valuable stretch of salmon or trout water which is neglected and virtually unfished, and, say, 500 acres of average farming land where the owner is content to frighten a few September partridges, and perhaps bag a handful of hedgerow pheasants for his larder. Pheasants are hardy, adaptable, and catholic of taste. It is rare that they cannot be made to crop consistently well—and not only in woodlands—for large numbers of pheasants are shot on Lincolnshire farms with hardly a tree on the place. During the last few years our game Advisory Officers have been asked to survey over two and a half million acres of farming land. It is rewarding to see that farmers are becoming more and more game-minded. And nothing succeeds like success.

Sugar Beet Yellows

The Search for Control

R. HULL, PH.D.

Rothamsted Field Station, Dunholme, Lincoln

Complete control of virus yellows is not yet possible, but demeton-methyl is a most useful weapon against the aphids which carry the disease. Meanwhile search still goes on for resistant varieties of sugar beet.

SUGAR beet growers in south-east England, and indeed in many parts of Europe, had a sharp reminder in 1957 of the very serious effects virus yellows disease can have. Yields in the Suffolk and Essex beet sugar factory areas, where the outbreak was severe, were up to 3¾ tons per acre below average, whereas in the north and west of England, where it occurred later and was less widespread, yields were up to 1¾ tons per acre *above* average. Losses in Great Britain from yellows in 1957 are estimated to be about a million tons of roots, which is slightly more than in the last bad outbreak in 1949.[1] About half this amount was lost in 1952, but in 1950 and 1951 the disease was less severe, and since 1952 its incidence has declined steadily.

The incidence of yellows depends on many interacting factors. Two of the most important are the number and activity of the aphid vector *Myzus persicae* early in the summer, and the number of infected plants from which they pick up the virus. Severe outbreaks have generally occurred after the incidence of the disease has increased over two or three years. In 1956 the disease reached its lowest level for many years, which seemed to augur well for the 1957 crop, for in the autumn of 1956 there were few plants infected with yellows virus to survive the winter. However, green aphids invaded sugar beet crops exceptionally early in 1957 and multiplied quickly: peak populations were reached by the end of May (earlier than for twenty years past) on beet in the south and south-east. They had thrived throughout the mild winter outdoors on all sorts of vegetation, and they spread and multiplied fast in the favourable spring weather, carrying yellows virus rapidly amongst the young, susceptible plants. In some fields seedlings were infested with aphids as they emerged from the ground. The spread of yellows was accentuated at singling, when aphids crawled off wilting, uprooted plants to those remaining in the ground. In occasional fields in Sussex, Essex, Suffolk and south Cambridgeshire all plants had yellows by the end of June, although the aphids were killed by spraying the brairds before singling in May.

Sources of infection

That *Myzus persicae* would arrive early on sugar beet was expected, but such a sudden and early development of yellows was not. Many winged aphids must have carried the virus to beet fields: undoubtedly some aphids

came from mangold clamps, which were numerous, large and heavily infested. In coastal areas some came from wild beet, on which they overwintered. Many annual weeds thrived during the winter and aphids lived on them; chickweed, groundsel, pimpernel, pennywort and several others are susceptible to yellows virus. Field surveys in previous years have indicated that they are not usually an important source of infection in spring because infected plants have been rare, and seldom have any aphids been found on them. Perhaps the association of aphids with susceptible plants throughout the mild winter of 1956–57 caused the disease to spread amongst weeds, and resulted in many virus-carrying winged aphids being produced on them in the early spring. Fortunately this is not a common occurrence in the English climate, for it makes the problem of controlling yellows much more difficult.

Eliminating overwintering sources of the virus has been the main control measure so far recommended for the root crop.[2] As a result of the control measures adopted for beet and mangold seed crop stecklings in 1951, in conjunction with the certification scheme, most seed crops now have few infected plants, and consequently have ceased to be an important source of infection for root crops. But more infected mangold stecklings were found in the autumn inspections in 1957 than in any previous year. Growers are recommended to spray their seed crops with systemic insecticides this month: this will prevent green aphids multiplying early on the seed crop, and thus reduce the risk not only of direct aphid injury, but of loss of yield from further spreading of yellows within the crop. It will also greatly reduce the risk of yellows spreading to neighbouring sugar beet and mangold root crops.

Aphid-infested mangold clamps are as numerous and widespread as ever; indeed there were more than usual in the spring of 1957. Undoubtedly the best way of avoiding the risk of yellows spreading from clamps to young root crops is to feed the mangolds to stock before April, burn the clamp debris and plough the site, so freeing it from the weeds to which aphids may have crawled from the clamp. Some farmers need mangolds for their stock in spring, and cannot use alternative feedingstuffs. They should make a separate clamp for the mangolds that are to be fed late, and these should be treated in autumn to free them from aphids. The recently changed recommendations for the use of demeton-methyl insecticide now permit its use on mangolds not less than two weeks before harvesting. In experiments, spraying mangold crops shortly before harvesting has killed the aphids on the leaves, and resulted in clamps free from aphids in the spring. Only that part of the crop which will be wanted for feeding stock after early April need be sprayed, but it must be clamped separately. This control measure will be tried on a limited commercial scale in 1958.

Effect of spraying on yield and sugar content

The development of the systemic insecticide demeton-methyl has made possible a notable advance in the control of yellows in root crops. It is a very effective aphicide, persistent, systemic, relatively cheap and, provided reasonable precautions are taken, it can be used without undue risk to man or beast. In field experiments over several years, spraying has reduced the incidence of yellows and increased yields—to a worthwhile extent when more than 20 per cent of the unsprayed plants were diseased at the end of

August. The spray was effective when applied at any time during the early stages of colonization of the crop by *Myzus persicae*, which usually means during June. Little extra benefit was obtained from a second spraying, but most of the experiments were made in fields only slightly infected, so the results of the 1957 experiments, many of which were on fields in which the unsprayed plots were infected both early and heavily with yellows, give better evidence on this point. In fields where aphids recolonized the crop after the first spray, with consequent late spread of yellows, a second spray was economically worth while in 1957. On twenty experiments in 1957, distributed throughout the beet-growing areas, an early spray gave an average increase of 1¼ tons per acre of roots, a later spray ¼ ton and the two sprays together 1½ tons. The early spray increased the sugar percentage by 0·3, the late one increased it by 0·1 and the two together by 0·4. Early-sprayed plots gave 13 per cent more sugar per acre than unsprayed, late-sprayed 4 per cent more, and twice-sprayed 17 per cent more. The two sprays increased the juice purity from 85·5 to 86 per cent—a small effect, but an important one to the sugar manufacturer. The effects were greatest in experiments in the south-east, where yellows was most prevalent. On average, in six experiments the early spray increased yield of sugar per acre by 29 per cent, the late spray by 8 per cent and the two sprays together by 36 per cent. In eight experiments in the east and Midlands the responses were 6 per cent, 5 per cent and 11 per cent to early, late and twice-spraying respectively. In four experiments in the north, where yellows incidence on the unsprayed plots was less than 20 per cent at the end of August, spraying did not increase yield to any measurable extent.

As a result of the warnings issued when aphids became prevalent, about 100,000 acres of beet were sprayed. Some farmers were disappointed with the result because their crops eventually developed yellows, but this does not mean that the treatment was not beneficial. Spraying reduces and delays infection but seldom prevents it altogether, and the experimental results leave no doubt that timely spraying produces large increases in yield. However, it must be timely, and much of the commercial spraying in 1957, and even the early sprays at the end of May in the experiments, were too late to give the maximum effect. But aphids were exceptionally early in that year. In a few fields, although the brairds were sprayed before singling, all plants developed yellows in early June and no benefit was obtained. This was the result of the crop being invaded early by large numbers of virus-carrying aphids, which infected all plants before they were sprayed. In other fields the proportion of such aphids must have been smaller, because although all the plants were infested, spraying decreased the incidence of yellows. This points to the importance of reducing virus sources, and not depending solely on spraying for control.

After their experience in 1957, some farmers in areas where yellows occurs fairly regularly intend to spray their crops in May or early June as a routine. A second spray can be applied if it is needed. They consider that apart from giving them peace of mind it will be worth while, even if in some years the spray gives no benefit because yellows is not prevalent.

Other farmers, especially in areas where the disease is sporadic, will wait to see how the aphids develop. The best time to spray is when aphids begin to invade and multiply on the crop, and it may be recognized when, on

average, there is a green aphid on every other plant. In most seasons it is not easy to decide when to spray. The agricultural staff of the Sugar Corporation intend to make daily observations, as they did last year, so that aphid build-up in a district can be detected, and farmers warned to spray their crops. But aphid infestation varies widely from one field to another, so although the warning system may help on a district basis, farmers should watch their own crops and be prepared to spray as soon as green aphids can be found easily on the undersides of the leaves.

Breeding for tolerance

We are often asked, "Cannot varieties resistant to yellows be bred?" The successes in breeding against such diseases as curly top, cercospora leaf spot and black root are held up as examples. Much experimental work and commercial breeding is in progress to improve the resistance of our varieties. But no simple genetically-controlled mechanism for resistance to yellows has been found so far. Although no sugar beet plants are immune, they differ slightly in tolerance; that is, one plant will suffer less yield loss than another when infected.

These differences have been exploited at Dunholme by raising inbred lines from such tolerant plants. After screening the progenies in artificial infection trials for three generations, and selecting the best yielders—a seven-year process—we multiplied them to give enough seed for field trials. Some of these progenies had a first thorough test in conditions of natural infection in 1957. The trial was in Suffolk, and most of the plants showed yellows by mid-July. Two progenies outyielded Battle's E variety by 13 and 16 per cent, and Sharpe's Klein E by 27 and 30 per cent respectively. Not only did they yield more sugar per acre, but they looked greener throughout the summer and showed symptoms more slowly. This gives a sound basis for hope that varieties can be produced which will be less affected by yellows than those in general use at present.

The 1957 epidemic has demonstrated the need to be continually alert if serious losses from yellows are to be avoided; fortunately it has also shown that there are measures for controlling the disease. If we learn how to use them most effectively, better results can be achieved now, and we can hope for improvement in the future. But none is adequate by itself, or likely to prevent serious losses when conditions unusually favour the disease.

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Eelworm Control

Some Aspects of Past and Present Research

R. D. WINSLOW, B.AGR.(BELFAST), PH.D.(CANTAB.)

Rothamsted Experimental Station

Whilst scientists are seeking eelworm-resistant plants and pursuing methods of biological control, crop rotation is still the best way of checking eelworm infestation.

OF the cyst-forming eelworms or nematodes (*Heterodera* spp.), the potato root eelworm still remains the most important to the British farmer. Other cyst-formers capable of causing serious crop losses are the beet, cereal, pea, cabbage and carrot root eelworms. Root-knot eelworms (*Meloidogyne* spp.), formerly regarded in this country as pests of crops under glass only, have been found parasitizing various crops in the field, but attacks are not usually serious and tend to be confined to the more southerly (warmer) regions. Other root-feeding eelworms which may be causing more crop damage than is realized are the meadow (*Pratylenchus*), stylet (*Tylenchorhynchus*), spiral (*Rotylenchus, Helicotylenchus*), lance (*Hoplolaimus*), pin (*Paratylenchus*) and stubby-root nematodes (*Trichodorus*). Potato rot or tuber eelworm (*Ditylenchus destructor*) can cause considerable damage to potato tubers; a close relative is a pest of mushrooms. Various races of the better-known stem eelworm (*D. dipsaci*) parasitize a wide range of agricultural and horticultural crops, frequently causing serious losses in sugar beet, oats, onions, clover, lucerne and bulbs. Bud and leaf eelworms (*Aphelenchoides* spp.) attack such diverse plants as chrysanthemums, strawberries, currants, begonias and ferns, and the leaf-, flower- and seed-gall nematodes (*Anguina* spp.) cause galling in wheat and certain grasses.

Established methods of control which have been more or less successful include crop rotation to starve the nematodes; disinfestation of the soil by steam, and of soil or growing plants by chemical means; disinfestation of dormant plants such as seeds, bulbs, tubers or stools by warm water or chemical treatment; and farm hygiene and quarantine to limit existing infestations. With sufficiently wide rotations, eelworm problems could be largely eliminated, and this method remains the one most generally useful to the farmer. Such rotations, unfortunately, do not always lead to the most profitable use of the land. Warm water or chemical treatment of plants is largely confined to a few specialized horticultural crops; steam sterilization and chemical treatments of soil are usually too expensive except for crops under glass; and quarantine and hygienic measures, such as the cleaning of implements and the use of "clean" seed, while highly desirable, are difficult to apply rigorously in everyday farming.

Exploiting the hatching factor

There are a number of other approaches to the problem which scientists in various parts of the world are investigating. These include various

methods of biological control, in which the biologist uses his knowledge of the behaviour of the nematodes and their associations with other living organisms in the soil. The potato root eelworm (*Heterodera rostochiensis*) and related species occur in infested soil mainly as "cysts"—dead females filled with eggs. Each fertile egg when fully developed contains a coiled larval worm. This is the dormant or encysted stage in the life cycle of the pest. During a season in which a host crop is not grown, a proportion of the larvae (roughly half of them in the case of the potato root eelworm) hatch from the eggs and leave the cysts. Although they can live in the soil for some time without food, these larvae will die from starvation within a year or so. If host crops are withheld for a number of years, the cysts are gradually emptied of viable contents, until the infestation falls to a safe level and a host crop can again be grown successfully. Hence the value of crop rotation.

When a host crop is grown the great majority of the surviving larvae hatch from the eggs and emerge from the cysts to invade the roots and feed in them, eventually developing into adult males and females. The dead bodies of the latter, filled with eggs, form the new generation of cysts. We may regard the attack on the crop as occurring in three stages: hatching of the larvae and their emergence from the cyst, invasion of the roots, and development within the roots. Various research workers have investigated these stages, particularly in the case of the potato root eelworm, and a few of the relevant findings and deductions are given below.

Hatching of the larvae is stimulated by a substance, the "hatching factor", contained in the "root diffusate" which growing roots of potatoes liberate into the surrounding soil. A great deal of research has been done to determine the exact chemical nature of the hatching factor, so far without real success. At best we can say that it is an organic acid or group of acids of a rather complicated nature, occurring in minute concentration in the root diffusate.

In the invasion of the roots greater numbers are said to enter the rootlet just behind the growing tip than elsewhere. This suggests that they are attracted to the roots and most strongly to that portion just behind the root tip. (Current investigations at Rothamsted tend to confirm this view.) Presumably the root diffusate contains a chemical "lure" as well as the hatching factor. These may be identical, or they may be separate substances. Development within the roots is dependent on many factors, such as suitability of the root tissues as food, concentration of the nematodes within the roots, and growth conditions for the crop.

While chemical control of cyst nematodes is usually directed at the dormant stage, certain biological control measures, on the other hand, tend to apply more to the later stages. Once the larval worms have hatched and emerged into the soil, they must enter the roots and develop there if they are to survive and reproduce. By stimulating larvae to hatch and then interrupting the life cycle before they can mature, the biologist can eliminate these worms. There are a number of ways in which this could conceivably be done. For instance, the hatching factor could be applied to the soil in the absence of a food crop. Root diffusate containing the potato eelworm hatching factor can be obtained in aqueous solution, simply by adding excess water to potatoes growing in pots or beds and collecting the liquid which drains through. This liquid, applied to infested soil, should stimulate hatch-

ing and the hatched larvae would die from starvation. But both production and application of the vast quantities of liquid required would be costly and the whole operation very uneconomic. A refinement of the technique would be to produce a cheap synthetic substitute for the factor which could perhaps be applied more economically. But this requires greater knowledge of the chemistry of the hatching factor than is yet available.

Potato root eelworm: trap-cropping

A more promising method is that of trap-cropping. Early attempts were made to control the potato root eelworm in this way by planting potatoes in infested soil, waiting until the larvae had invaded the roots, then destroying the crop before the developing worms had reached maturity. The trapped worms were killed, greatly reducing the infestation. Although the method was successful on an experimental scale, it was regarded as too risky for use in the field, since the timing and thoroughness of destruction of the crop were critical. Failure to destroy completely and in good time, owing to adverse weather or other causes, would lead to the production of a new crop of eelworm cysts, resulting in an increased, instead of decreased, infestation. Such a method was also wasteful of land, labour and seed.

Attempts were made to use the related black nightshade, instead of potatoes, as the trap-crop. The advantage was that the eelworms could not develop fully on nightshade; larvae were stimulated to hatch and readily entered the roots but perished in them, no new cysts being formed. Although nightshade was in this respect the ideal trap-crop, reduction of infestation by growing it in field-plot trials did not come up to expectations. Besides, nightshade is not only a worthless plant from the farmer's point of view; in many potato-growing areas it is a noxious weed.

Breeders' search for resistant potato

Far more promising prospects appeared with the discovery that certain lines of a South American potato (*Solanum tuberosum andigena*) were resistant to the potato root eelworm, though the tubers were very small and of very poor quality. The type of resistance was like that shown by nightshade; the larvae were stimulated to hatch and invaded the roots, but could not develop fully in them. Crossing some of these eelworm-resistant potatoes with our cultivated varieties produced hybrids with the eelworm-resistant qualities of the South American parent and improved tubers. The plant breeders were confident they could produce new potato varieties combining eelworm resistance with satisfactory yield and quality. This appeared to be the answer to the potato eelworm problem: not only would the pest be prevented from multiplying by growing resistant potatoes, but it would actually be greatly reduced in numbers because of the trap-cropping action.

In this apparently admirable state of affairs there lay a special danger, as the plant breeders well knew. In general, the better the resistant trap plant, the more closely it resembles the susceptible host plant (for on this resemblance depend its trap-cropping properties), and the smaller the physiological difference between the two plants. Individual potato root eelworms, like individual humans, differ from each other, and some may be able to sur-

mount this physiological barrier and develop successfully on the hitherto resistant plant. Something like this has happened; we have recently discovered in Britain populations of the potato root eelworm capable of attacking those South American potatoes we thought resistant. So the plant breeders and nematologists have to start at the beginning again, and search amongst wild potatoes for parent breeding material with more universal resistance to the nematode. Such material may well be less closely related, genetically, to cultivated varieties, making the breeding programme more difficult than before, but the plant breeders are well used to overcoming such difficulties in breeding for resistance to various pests and diseases, and the prospects of eventually producing a completely resistant potato are good.

In passing, we may note that certain wild beets and crucifers and barley varieties show similar resistance and trap-cropping qualities in the case of the beet and cereal root eelworms respectively, and that certain oat varieties resistant to the stem eelworm are known, though in this last instance the resistance may be of a different nature.

Predators and parasites

Another interesting method of biological control, which we might call the "classical" method, is to introduce and encourage organisms known to be predators or parasites of the pest. Certain small insects (*Collembola*) and mites, which eat the contents of eelworm cysts, are being studied at Rothamsted. Nematodes of the genus *Mononchus* feed on other nematodes, including plant parasites. A large number of fungi and bacteria are known to be predators or parasites of nematodes. Some of the fungi are striking in their methods of capturing the worms. Snares in the form of loops of fungal thread, which enclose nematodes trying to pass through, and sticky loops and knobs are some of the devices used; and these may be followed by the production of toxins to immobilize the prey. While these various enemies of nematodes are often spectacular in action and of great interest to the biologist, evidence to date does not suggest that they are likely to be of much economic benefit to the farmer.

Research goes on

An unusual method of control tried out in Rhodesia was that of passing an electric discharge through infested soil. Initially it was claimed that promising results were obtained in trials against root-knot nematode, but in recent tests in America this method was not successful.

Methods of the future may include use of radio-active materials. Irradiation of insect pests with sub-lethal doses of gamma rays or X-rays has had some interesting effects, including that of making the insects, particularly the males, sterile. It remains to be seen whether this method has any application in nematode control. For the present, the farmer must rely mainly on crop rotation, while the biologist continues the search for resistant varieties and other possible means of control.

Farm Woodlands: Past and Present

H. L. EDLIN, B.SC.

Forestry Commission

There are good reasons, both utilitarian and aesthetic, for having trees on farms. Spinney, coppice, hedgerow and shelter-belt all have their place—and an interesting history.

INCREASING attention is being paid to trees and woodlands on the farm today. One reason for this is the growing number of owner-occupiers. In the old days, when most farmers were tenants, they were content to leave the control of trees in the hands of their landlords; indeed they were often obliged to do so by clauses in their leases reserving all timber to the estate. Even where woods were surrounded by farm lands, it was customary for the landowner to manage them, with the three main objects of timber production, sport, and the maintenance of general estate amenities, including both shelter and scenery. With the gradual dispersal of large properties, great numbers of hedgerow trees have come into the possession of farmers, while very often small outlying woods, coppices, and shelter-belts have been sold with the farms. The estate forester, with his professional knowledge, is no longer concerned with their upkeep, and the new owners must look elsewhere for guidance.

In 1955, the Forestry Commission published the Report[1] of a committee appointed in 1953 to examine the problems that may arise in the growing and maintenance of hedgerows and farm timber. Statistical information provided by the Commission's census of hedgerow and farm timber and small woods[2] shows that, in 1951, England and Wales held about 66 million sizeable hedgerow, farm, and park trees, which accounted for about one-fifth of the national timber reserves. The number of small woods was estimated at 57,000, and they had an aggregate area of 150,000 acres. A multitude of owners, with holdings of very different size and character, have a share in this not inconsiderable woodland property; in fact its dispersal over the country as a whole adds greatly to its value for shelter and as scenery.

Three kinds of small woods

How did this large, if scattered, forest estate come into being? Broadly speaking, it has three main origins. Much of it is best described as "left-over land"; that is to say, it is what remains after all the better ground around it has been taken up for farming. Some of this has never wholly lost its primeval woodland cover. The hedgerow trees and some associated belts and spinneys are by-products of the great enclosure movement; after the hedges had been established, the trees sprang up along them, usually from chance seedlings or sucker shoots. The third group comprises belts and blocks that have been deliberately planted for shelter in fairly recent times.

If you take up a six-inch or twenty-five-inch map of a typical country parish, you will find it quite easy to classify the small woods into these three

groups. The "left-over land" is characterized by its irregular outline, for it follows the general run of the ground, occupying steep slopes, rocky outcrops, narrow dingles, marshes, and so forth, unfitted for cultivation. The hedgerow trees are not shown on the map, but their situation follows the lines of the plotted field boundaries; here and there these broaden out into narrow belts—sometimes deliberately planted, but often of casual origin—for example along streams or sunken roadways. The recent plantations are clearly apparent because of their regular shapes—squares, oblongs, circles, or other figures that reflect a planned and preconceived fence line.

Left-over land

The "left-over land" naturally has a very long history, and has probably been treated in different ways at different times. Its trees are virtually all broad-leaved; conifers will appear only if they have been introduced in fairly recent times. As a rule, the broad-leaved trees have been coppiced, that is to say, cut back at intervals of a few years so as to yield small poles well suited for firewood, fencing, hurdle-making, and odd jobs about the farm. Until about 1850, most cottagers and small farmers relied on their own copses for fuel, and it was reckoned that an average family needed from five to ten acres to keep itself constantly supplied. Hence it is very common to find a small wood or two of this kind associated with a farmstead. This is particularly so in Wales, where quite large coppices on steep hillsides often have many separate owners, each man claiming a block of five acres or so which was once his family woodlot. With the coming of coal and oil as rural fuels, such woods are now seldom worked. Sometimes it is possible to find in them enough straight stems to form a useful timber crop of broad-leaved trees. Otherwise it is better to clear the crooked stems, recovering part or all of the cost by their sale as firewood, and then to replant; the Japanese larch has proved a useful tree here, as it generally outgrows weeds and worthless shoots from the old stumps.

Hedgerow trees

Hedgerow trees are mostly of natural growth, arising as a rule from the chance acorn dropped by a bird or a squirrel, or the winged ash seed wafted by the wind. Most elms, however, spring from sucker shoots arising from the roots of an older tree nearby. Whatever their origin, the saplings owe their survival to the protection they get from the spiny hawthorns of the hedge. Once they reach the top of the hedge, they are very liable to be beheaded by the hedger's billhook when the hedge is next cut and laid. But there is a long-established custom, in many districts, of preserving a proportion of promising young trees. On some estates, in fact, the hedgers were paid sixpence for every such tree they found and saved. To this process we owe nearly all our wealth of hedgerow trees and timber, few of which were ever planted deliberately. It is a cheap and easy method of ensuring a sufficiency of shade and shelter, and a reserve of timber for home use. Hedgerow trees have their critics, but a convincing argument in their favour comes from the cattle and sheep that shelter below them from the scorching sun in summer and the driving snow in winter. It would be idle to deny that they

take something from the land, but they do at length yield a return as timber, while they are the cheapest form of shelter and windbreak known.

Shelter-belts

The planting of belts of trees deliberately for shelter is a fairly recent development in the history of the countryside, for there was no need for them until the ancient forests had been cleared. During the eighteenth and nineteenth centuries many of the great landowners laid out such belts on the grand scale, to enhance the value of their parks and farms. In upland districts, particularly, they were thus able to push the limit of cultivation higher, and so increase their rent rolls. A second form of shelter planting consists of small isolated blocks right out on the hill pastures, which provide shelter to sheep from winter blizzards, since they can always get out of the wind on one side or another. Both belts and blocks became well developed; for example, in Northumberland, and even more so in the Tweed valley across the Border. Unfortunately the present century has seen a sad decline in shelter-belt planting and maintenance; as the trees matured there has been a temptation to cash in on them for timber, especially when an estate has changed hands, regardless of the fact that their worth as shelter for farmlands round about may be even higher. The need for shelter trees close to the farmstead is self-evident, and those have generally been well maintained.

Recently there has been a revival of interest in shelter-belts, following rather belatedly on the great schemes for preventing "dust bowls" on the prairies of America and the steppes of Russia. The Ministry of Agriculture has issued a leaflet[3] giving simple and straightforward advice on their establishment, and the Forestry Commission has produced a pamphlet[4] dealing with the particular problems encountered in Wales and other upland regions.

On the more fundamental side, Dr. J. M. Caborn has carried out field and laboratory experiments on actual and model belts, his results being published as a scientific bulletin.[5] An interesting fact that emerges from his work is that the kind of belt with sloping sides which is favoured in America and Russia is the *least* efficient aerodynamically; the ordinary belt with vertical sides provides a much better brake on the flow of the wind. Such a belt will give effective shelter, on level land, for a distance equal to twenty times its own height; thus a belt 60 feet high will protect a field 400 yards wide. The overall increase in yields from crops or livestock commonly exceeds the loss of yield from the land used to grow the belt. There is little advantage in making a belt more than one or two chains—22–44 yards—wide; the broader belt simplifies management, because half can be felled and replanted first and the other half later, so avoiding any complete absence of protection.

Poplars and fen blowing

A special form of farm planting is found in the poplars and willows grown on the rich and well-watered lowlands of the eastern counties. Lt.-Col. E. R. Pratt, who has pioneered the planting of poplars at his Ryston Hall estate near Downham Market in Norfolk, has found that these trees, though spaced at twenty feet apart because of their rapid rate of growth, do give very effective protection against the blowing of light fen soils in spring. In addi-

tion, their timber, which matures in about thirty years, is readily saleable for the making of matches and chip baskets for fruit. Willows are traditionally grown as pollards along river banks for the production of small poles for fencing and hurdle-making. But nowadays the only kind that really pays is the cricket bat willow. On fertile and well-watered land this can provide a very good return, but it is essential to start with the true strain, *Salix alba* variety *caerulea*. The Forestry Commission issues a leaflet dealing with the raising of poplars,[6] and a bulletin[7] on willow-growing.

Grants and technical advice

The techniques of raising trees have been outlined in recent numbers of *Agriculture*,[8] so it only remains here to list the sources from which assistance can be obtained, and current publications with a close bearing on farm timber. Under the Hill Farming Acts 1946 to 1956, and the Agriculture Act 1957, the Ministry of Agriculture may make grants equal to one-third, or on hill farms to one-half, of the cost of making shelter-belts as part of a farm improvement scheme; application for these should be made to the County Agricultural Executive Committee. Alternatively, a small woods grant, at the rate of £17 per acre, may be obtained from the Forestry Commission. The Commission is also prepared to give free technical advice to farmers on any question affecting timber production. Details of its schemes of assistance, and the addresses of its local offices, will be found in the pamphlet *Grants for Woodland Owners*, obtainable from the Commission at 25 Savile Row, London, W.1; but it should be noted that the minimum area needed to qualify for a grant has recently been reduced to *one* acre. In many districts, particularly in Wales, the co-operative forestry societies, which enjoy the support of the Commission, can also assist the small woodland owner.

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N.A.A.S. Experimental Husbandry Farms

Gleadthorpe

P. J. JONES, B.SC.
Farm Director

GLEADTHORPE has been an Experimental Husbandry Farm since 1949, when it was purchased to be the experimental farm on sandy soil in a low rainfall area. Situated in the Sherwood Forest area of Nottinghamshire, aptly named the Dukeries, it is some seven miles from both Mansfield to the south-west and Worksop to the north, and about fourteen miles to the west of Retford on the A.1 road.

The area is 493 acres, of which 260 are arable and 130 in temporary leys, while 60 acres adjoining the river Meden are in permanent grass. Most of the fields are undulating, some with very steep banks, and the elevation varies from 150 to 250 feet. The soil, known locally as the Sherwood Forest sands, is derived from the Bunter sandstone and is in places very stony—mainly pebbles from the Bunter pebble beds. It blows very readily. The average rainfall is 24 inches a year, and the combination of light, blowing sand and low rainfall makes Gleadthorpe a farm on that kind of land which, during times of agricultural depression, readily went out of arable cultivation. Between the wars such land was often let for as little as five shillings an acre! Being almost completely surrounded by woods and commons, Gleadthorpe was badly overrun with rabbits, and continual war had to be waged against them. Myxomatosis first appeared in the spring of 1955, but it soon became obvious that many of the rabbits were recovering from the disease. However, as a result of the efforts of the pests officers, and more recently of the return of myxomatosis, the numbers are being kept under control. Because of the experimental work on the farm it became advisable to erect some 6,000 yards of rabbit-proof fencing to protect the trials from damage.

In farming this type of soil, the main problems are the necessity to conserve soil moisture during cultivations, the need to improve or at least maintain the level of organic matter in the soil, and also the need to increase the reserve of plant nutrients—lime, phosphate and potash. Much of the experimental work at present being carried out is designed to investigate these problems and is best considered under these headings.

Soil moisture

It is easy to measure the increase in crop yields when adequate moisture is provided, but not so easy to establish that any particular type of cultivation has helped to conserve moisture. It is obvious that irrigation of certain crops is of enormous benefit. At Gleadthorpe it has been possible to raise the yield of sugar beet from 5 to 17¼ tons an acre, and of maincrop potatoes from 5 to 11½ tons an acre. Such increases are not obtained every year, but according to meteorological records irrigation would be beneficial in at least

six years out of ten. A dry summer gives high temperatures and long hours of sunshine. If sufficient moisture can be obtained by irrigation, then conditions for plant growth are excellent, and much higher yields of such crops as sugar beet can be expected than in a wet year. More information is urgently required on when and how to apply water, particularly to early potatoes, and it is hoped to extend the work on irrigation this year to investigate these points.

For all crops, but particularly for root crops, the land is worked to the minimum in the spring to help conserve soil moisture. Fortunately, a tilth can readily be obtained on the sand: for cereals, twice over with the harrows is usually sufficient, but for root crops additional levelling and consolidation are necessary. It is essential to be early with all spring crops. Cereal drilling starts in January if weather permits, sugar beet by mid March and the small seeds, when undersown, within a day or so of the seed corn. All this is to ensure that the plants become well established before the dry weather arrives. The spring weather is often dry and cold, but, provided the plants have had time to develop a good root system, there is rarely much evidence of water shortage until towards the middle of June. Planned irrigation from then on is of benefit in most years.

Organic matter

Conditions on the Bunter sand are usually ideal for the growth of soil bacteria, and organic matter is quickly lost. The task, therefore, is to maintain its existing level, which over most of the farm is between 2·0 and 2·5 per cent, with some fields as low as 1 per cent. Various methods of returning organic matter to the soil are studied.

The direct value of farmyard manure is measured by the increase in crop yields, because the dressings applied are not heavy enough to affect the soil's organic matter appreciably. Regular soil samples are analysed to determine the effect on the organic matter, but it will be many years before reliable trends can be reported. Benefit from dung is therefore usually through the direct medium of plant food, and results indicate that even after a ley, dung gives an average increase of 1¼ tons of potatoes and over 2 cwt of wheat in the following crop. These increases in yield are thought to be due mainly to potash, because responses to potash are usually very marked.

As has been found elsewhere, the ploughing-in of straw has a delayed effect, in that the full benefit is seen in the crop *following* that for which it has been applied. Again, it is too early yet to be able to measure any differences in soil organic matter, but soil analysis suggests that applying dung or ploughing-in straw keeps the level of organic matter higher than if the straw is carted off or burnt *in situ*. So far burning the straw has had a less drastic effect than was expected, yields being maintained in the year of treatment but falling thereafter. This again may be a potash effect.

The value of a ley is being determined in two trials, the first of which is designed to measure the residual value of a ley left down for one year only without the benefit of livestock. The "seeds" treatments, which themselves are varied, are compared with arable rotations in which the leys are replaced either by potatoes or by mustard and lupins for ploughing-in green. Up to 1956 the yields from the arable rotations were higher than from the "seeds"

treatments, which led one to doubt the value of a one-year ley on this sandy land. Recently, however, the arable plots have not done so well, and it may be that there was some residual fertility which kept up yields in the early years.

The main ley trial is associated with livestock: three types of ley are left down for three years and then ploughed, and the fertility tested in successive years by potatoes, wheat and barley. The leys consist either of a lucerne and cocksfoot mixture (each year cut for silage first and subsequently grazed); or of a cocksfoot and white clover mixture (grazed with cattle or cut and conserved without being grazed). Three testing crops of potatoes have been harvested, and the evidence so far obtained shows that yields have been greatest where the leys have been grazed, and progressively smaller from the lucerne plots, the ley conserved, and the arable rotation. Two comments must be made on these results. The potatoes following the conserved ley yielded little in one year, and if in calculating the mean this is excluded there is little difference between the grass leys. The yield following the lucerne plots is perhaps disappointing but may be due to the difficulty at first experienced of establishing the lucerne. Six- and nine-year leys are also being tried, but it will be some years before results are obtained for these.

When the farm was purchased the soil was very acid; on certain fields the pH was as low as 4·6. Considerable quantities of lime have been applied (more than 2,600 tons—an average of over 5 tons an acre), and now all that is required are routine dressings to keep the pH around 6·5.

Analyses of the soil show it to be medium to low in available phosphate and low in available potash; this is typical of the sandland in the area. Experiments have been started to measure the response of various crops to different levels and quantities of phosphate and potash, and in many of the other trials different levels of fertilizer are included. Valuable information on the long-term effects will therefore become available in a few years.

The farm rotation at Gleadthorpe is based on either a two- or three-year ley—either lucerne and cocksfoot grown in alternate rows 10 inches apart or a cocksfoot and white clover mixture. The first has been very successful and has made the management of the sward much easier. About 350 tons of silage are made annually, but only sufficient hay for the calves and for out-wintered stock in really severe weather.

Silage therefore plays an important part in feeding the livestock. Until recently, most of it was made in pits but, even on this land, drainage became a problem and gradually more and more is being made above ground in silos with prefabricated concrete sides. New cattle yards recently completed are designed to permit self-feeding of silage. Efforts are being made to improve the silage by wilting it for twenty-four hours before making; there is no difficulty in temperature control, and it gives an appreciable increase in dry matter. Such silage is relished by the cattle.

Livestock

The principal livestock enterprise is the production of beef. We buy Friesian bull calves about 4 days old and rear them for about five weeks on nurse cows, followed by a week or two on a milk substitute. They are on the farm until ready for the butcher, during which time they are used in experi-

ments. The main investigation is into the outwintering of yearling cattle as a means of cheapening beef production. The cattle are outwintered either on foggage (this is another reason why the cocksfoot is drilled in rows), on kale strip folded, or self-feed silage from a clamp in the field, while a similar group is fed silage in a yard.

So far our foggage here has not been entirely successful. Trials with it started in 1954, but in that winter the cattle lost on average ½ lb a day and finished nearly 1 cwt lighter than silage-fed cattle. Twice during the period the foggage group had to be fed silage because the snow was too deep for the animals to find food. The following year was so dry that the grass did not grow and the foggage had to be replaced by silage. During the 1956–57 winter, which was one of the most open winters for many years, the foggage cattle again lost weight. The cattle on kale and beet tops increased in weight at the rate of 1·2 lb a day, and finished the winter 1¼ cwt heavier than the foggage bullocks. During the summers of both 1955 and 1957 the liveweight gain of the foggage cattle was the greater, but they never caught up with the other cattle.

Other work is in progress to measure the effect on cattle of implanting hexoestrol, and this winter a comparison has been made between the progeny of selected Friesian bulls as beef animals.

Poultry—a flock of about 4,500 layers—is the other important livestock enterprise. A breeding flock of Rhode Island Reds is kept, and 6–7,000 chicks are reared each year. A thorough investigation into methods of housing has emphasized the value of intensively-kept birds for egg production, with the battery birds producing more than those on deep litter. The results of the work done on protein supplements have already been published. Experimental work on breeding from birds kept intensively is about to start: this will include tests with artificial insemination on battery hens.

Although Gleadthorpe has been an experimental farm for only eight years, information is already coming forward from some of the trials in progress. Much more will be available when the long-term trials have been running longer. The value of much of this work is of course greatly increased because it is repeated on other husbandry farms representing different soil and climatic conditions. Each farm's Director is advised by an Advisory Committee of local farmers, representatives of nearby universities and senior N.A.A.S. officers. This is an excellent arrangement and I should like to place on record my appreciation of the valuable help given to me by my Committee.

Household Bird

For most of us our first excursion into the escapist field of whodunnit fiction must doubtlessly have been the investigation into the fate which overtook Cock Robin at the hands of the toxophilite sparrow. We remember, too, the earlier account of the marriage of Cock Robin and Jenny Wren, and the indefatigable labours of this partnership on behalf of the Babes in the Wood.

So from those very early and most impressionable days of childhood we have grown up to recognize that the robin has a rather special place in its association with man.

Local sayings, although diversified by geography, are all agreed on the dire consequences befalling the person who harms this "household bird with the red stomacher", as John Donne described it.

Early Christian thought invested the robin with sanctity, and the legend that it acquired its red breast in its attempts to pull out the thorns from Christ's crucifixion crown has so far endured with the permanence, if not the authority, of Holy Writ. Celtic belief, however, has the variant that the bird daily flies to the Infernal Pit, bearing in its bill a drop of water to quench the flames. So in Welsh the robin is named "bron-ruddyn", breast-burned.

Fortunately, the robin has enjoyed immunity from the kind of insensate cruelty which was until quite recently inflicted upon its fabled partner, the wren. Why so much superstition should have been focused on this small, inoffensive bird it is impossible to say. To kill a wren or despoil its nest has always been held to bring the greatest misfortune, yet every Christmas the ban was lifted to allow of its being hunted and stoned to death to commemorate the martyrdom of St. Stephen. But the robin, confident and confiding, has learned no fear of man and ventures boldly where others fear to fly.

Among its own kind, however, the robin is a truculent individualist and jealous of its territorial rights in coppice and hedgerow, except when, under the mellowing influence of spring, breeding and nesting impose a truce between cock and hen. But out of such intransigence of spirit comes the pleasure of the robin's song—a song of advertisement, of sovereign assertion —and it is not the least in sweetness of our songbirds, whose "melodies alone are interpreters of thought, whose household words are songs in many keys". The full-throated, sustained melody of the immigrant nightingale, heard in the moonlight of a summer's night, may have captured the palm of the poets, but it is the cock alone who sings—and that for only a short period. Both sexes of robins sing, throughout the greater part of the whole year. The song of autumn and winter may lack the vigour of spring, as Lord Grey claimed to discern, but beauty may as readily be in the ear as in the eye of the beholder, for W. H. Davies added his tribute:

Robin on a leafless bough
Lord in Heaven, how he sings!

And at how many harvest suppers, I wonder, have the remembered obsequies of poor Cock Robin been sung with affectionate gusto and improvised harmony in the convivial atmosphere evoked by roast beef and old ale?

S. R. O'H.

Photo: *The late Arthur B*

Robin at nest.

Photos: *I.C.I.*

(*Above*) **Pheasant chicks hatched under a broody hen in a coop.**

(*Below*) **A release pen in a wood. These pens provide a playground and safe cover from predators.**

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Photos: *I.C.I.*

(*Above*) Brooder-reared pheasants in a release pen.

(*Below*) Pheasants using a winter feeding station on a farm.

Photos: *W. Hugh Smith*

(*Above*) Planting watercress near Dorchester.

(*Below*) Clearing a bed at the end of the season—late spring.

Recent Developments in the Cultivation of Watercress

W. C. IBBETT, N.D.H.

National Agricultural Advisory Service, South-west Region

New strains of cress and methods of cultivation are being developed, and fresh ways of packing should promote sales.

WATERCRESS has been cultivated in this country for about a hundred years. Most of it comes from Hants, Dorset and Wilts, but the old-established beds in the home counties still contribute their quota, mainly to the London markets, and more is now being produced in Lincolnshire. There are isolated beds in other areas, but these are mostly small and supply local markets.

Watercress can be produced all the year round, and is at its best from March to May. It commands the highest prices, however, in winter. During the summer it is difficult to carry long distances, and this has limited its sale in the north and Midlands. Hugh Smith of the Ditton Laboratory of the Department of Scientific and Industrial Research has recently experimented extensively on cooling cress, so that it can be sent on long journeys in hot weather.[1] He has found that watercress packed in corrugated cardboard containers with polythene liners, and containing crushed ice in polythene bags in each package, will keep fresh for forty-eight hours. The cress must be cooled before packing, and the experiments suggest that this can be done either by contact with crushed ice (preferably in a cool building) or by hydrocooling, which, since it is quicker, is considered the better method. In hydrocooling, the heat is transferred from the produce to a circulating stream of water, which is cooled either by ice or by a refrigerator coil. Some growers are now using ice in their chip baskets when sending cress long distances, even when only elementary methods of cooling (for example, with running water) are practised.

Although as a result of these methods the cress will arrive fresh at the retailers, it will not remain so for very long under normal shop conditions. Those who attended the Royal Counties Show at Poole in 1956 and saw the N.A.A.S. watercress exhibit may remember an insulated show-case, which clearly demonstrated how cress can be kept fresh and turgid in a retail shop for at least two days. This case, which was designed at the Ditton Laboratory, can be constructed cheaply, and consists of a wooden box lined with sheet metal and insulated with 2 inches of expanded polystyrene. The bunches of cress are stood stem downwards on a layer of crushed ice about 1 inch deep, lying on a false floor. Excess water drains through a hole in the bottom of the case. If retailers can be persuaded to display their cress in this kind of show-case, sales will be stimulated and waste avoided.

There appears to be a demand for pre-packed cress, mainly by self-service stores and supermarkets. Some firms buy cress in the market and pre-pack in polythene at the shop. Others buy it pre-packed, mainly in the form of

wrapped bunches. In America it is pre-packed in polythene bags each containing a lump of ice, but in this country the commonest method at present seems to be that of wrapping each bunch in clear film.

Types and strains

In the past, two main types have been grown—green cress and brown cress. At one time, brown cress was very popular in the southern counties as it was less badly affected by frost and so more useful for winter and spring production. Unfortunately, being a hybrid between *Nasturtium microphyllum* and *N. officinale*,[2] it does not normally produce seed and has to be propagated vegetatively. This has led to its virtual disappearance in some districts, perhaps owing to the incidence of virus. But Haigh[3] of the National Vegetable Research Station at Wellesbourne has just produced a brown cress that sets seed freely, and this will eventually be available for trial by growers; if it *can* be increased readily from seed, brown cress may come into its own again for winter and spring production.

The green types have green leaves, as opposed to the brown to purplish leaves of the brown cress. They are more vigorous and can be propagated vegetatively or by seed. A type of green cress (Cress A_4), raised at the Plant Breeding Institute, Cambridge, which is being tried to a limited extent, has broader and thicker leaflets than the normal type and is of high quality, but it is slower growing and yields less than the best strains of green cress. It breeds true from seed and adequate stocks can be raised without difficulty if growers generally take it up. Since the war, strains of the green cress have been introduced from America, Northern Ireland, France and Italy. The French stocks are rather similar to the English, but tend to flower earlier—a distinct disadvantage, as it restricts the period of cropping. By systematic roguing, some growers have built up first-class strains of the French types. The American and Northern Irish strains are rather mixed, but there are some good stocks available. So far, Italian strains have proved unacceptable to the English grower.

Recently, Bleasdale[4] of the National Vegetable Research Station has selected a type of green cress which flowers very late in the season, if at all. It can be raised from seed, and if taken up by growers could thus extend the season considerably, especially if combined with cooling. Doubtless this type will be favoured by those growers who wish to enter the summer market.

Virus diseases and crook root

A mottling of the leaves, with some stunting, may result from infection by one of the viruses (for example, cabbage black ring spot or cucumber yellow mottle). Work done at the National Vegetable Research Station by Tomlinson[5] suggests that viruses can seriously reduce the vigour and cropping of watercress. They are not transmitted by the common pests of watercress such as mustard beetle or flea beetle, but by several species of aphid. Since seedlings are free from viruses, the diseases can be kept under control by raising crops from seed, or by taking cuttings from healthy plants which have been raised from seed. In view of the great increase in seed-raised crops, it does not seem likely that viruses will affect production seriously in future.

Only one disease not caused by a virus is of real importance, crook root, so named from the curling or crooked ends of the young white roots. Affected plants lose vigour and their leaves become yellow. The disease is caused by a microscopic organism belonging to the order *Plasmodiophorales*, the spores of which penetrate healthy roots. The fungus then grows quickly through the tissues, causing the symptoms mentioned: it spreads rapidly, and a whole bed may be infected within a month. It is most damaging to the cress when growth is at its lowest in December, January and February. In bad cases, the underground parts of the plant rot away. As clean stocks can be raised from seed, some measure of control may be obtained by raising crops of green cress each year in this way.

In 1955–56, Tomlinson[6] of the National Vegetable Research Station introduced a zinc frit treatment with considerable success. Since soluble zinc compounds are impracticable because of the quantities of water involved, a search was made for a relatively insoluble substance which would release zinc over a long period. Zinc frit, a finely powdered glass containing 23 per cent zinc oxide, has given very promising results, both experimentally and on a commercial scale. The frit should be applied to the whole of the bed, at the rate of 1 lb per sq. yard, at the end of September or the beginning of October. Water flowing into the bed should be stopped, or much of the frit will be washed away. The bed should be allowed to drain for at least an hour after the water has been stopped: then the frit should be dusted evenly over the surface of the crop. After dusting, it should be washed off on to the floor of the bed. Water may be admitted after one hour.

The treated plants usually begin to grow more strongly four to six weeks after treatment, and the incidence of crook root is much reduced. Whilst the zinc content is higher than in the untreated beds, it is not high enough to make the plants unsafe for human consumption or to endanger fish. In the few cases where the beds are fed with soft water—for example, of greensand origin—trials should be conducted first on a small scale to note the effect on fish. Hooper and Till of the N.A.A.S., South-west Region, are at present carrying out trials to assess the value of materials cheaper than zinc frit, which costs about 1*s.* a sq. yard. In other trials, the disease has been completely eradicated by increasing the calcium bicarbonate content of the water to 500 parts per million, but this treatment is much too expensive to be of commercial use.

Small beds are best

For many years, cress has been grown in shallow beds lined with low concrete walls, in which water is allowed to spread to a depth of 2–3 inches. Usually the beds are in valleys in chalk or limestone districts, where natural springs and artesian wells supply the clean water necessary for the production of watercress. Water which comes from artesian wells has a constant temperature of about 50–52°F, and is warm enough to encourage early and continuous cropping. Changes in water temperature occur both in summer and winter. For example, the water in a bed 130 yards long, with the air temperature at 40°F, may have an inflow temperature of 50°F and an outflow temperature at the end of the bed of 42°F, a decrease of 8°F in 130 yards. In summer the temperature at the end of a similar bed may increase

by 7 or 8 degrees F. As the growth of cress is to a large extent regulated by temperature, there is now a tendency to reduce the size of beds so that the water may not cool too rapidly in winter or warm up too quickly in summer. Moreover, when water has travelled some distance through a crop, the cress does not grow so well. These factors, plus the fact that small beds are easier to plant and pick, suggest that the most suitable sizes are 120–150 feet long and 20–30 feet wide.

Up to and during the war years, many growers applied very heavy dressings of superphosphate, up to 3 tons an acre being used. Nowadays only light dressings of superphosphate are given: 1–2 cwt per acre after each crop taken. As an alternative, up to 6 cwt per acre may be given in spring. Some growers also give light dressings of nitrogen, "Nitro-Chalk" at 1 cwt per acre being favoured, as this granular material is easy to apply and does not stay on the leaves.

Crops from seed

Perhaps the greatest change in cultivation is the propagation of cress from seed rather than vegetatively. Before the war very little cress was produced from seed, but now some growers raise all their crops in this way. Others combine the two methods, raising seedlings each year and taking cuttings from them later in the season. Whole beds may be sown thinly and the resulting seedlings thinned out, but a newer tendency is to sow thickly at 2½ lb per 700 sq. yards, the plants being transplanted to other beds when 3–4 inches high. Small beds are better for raising plants than large ones, and it may be that in the future, cress growers will have a series of small nursery beds—for example, 4 feet wide by 20 feet long. Some growers now save their own seed from selected plants, building up strains true to the type they require. In this way excellent stocks are being produced by individual growers.

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Next month Mr. Hugh Smith of the Department of Scientific and Industrial Research will deal with the subject of refrigerating watercress.

Learning from the Land

ALEXANDER HAY, N.D.A., N.D.D., M.I.B.A.E.
General Secretary, Association of Agriculture.

How the Association of Agriculture is working to foster and stimulate the interest which should be common to town and country alike.

A WELL-KNOWN agricultural correspondent recently observed that it looked as though British farming could be aligned with the American nation in its almost pathological desire to be understood. In a society which is predominantly urban, it is unfortunately only too true that ignorance of the land and its problems is still a formidable obstacle to an understanding of the true relationship between town and country. On the other hand, the outlook is nothing like so bad as some critics of the agricultural industry's relations with the public would lead one to suppose.

As the General Secretary of an Association whose aim is to promote a better understanding of agriculture, particularly among the young people of this country, I cannot help feeling optimistic. Over the past ten years the Association has sought and found much interest and encouragement in many different quarters, especially among leaders of opinion in the educational world. The sympathetic attitude to country affairs which the Association often meets, and which it is always anxious to foster and stimulate, has succeeded in earning for agriculture and the land the established place in general education that it now enjoys. This place, it should be emphasized, is by no means confined to schools in rural areas. Experience has shown, in fact, that the interest is often greatest in towns and suburbs.

Increased interest in the land, while it is very welcome, has offered a growing challenge to the relatively few bodies, such as the Association, who are trying to meet the insistent and expanding demand for suitable teaching material. The correspondence which we receive every day points to the very real need of the teaching profession not only for text-books, maps and films, but also for demonstrations, conferences and lectures. Meeting this demand is not as easy as it sounds, for unless the approach is imaginative, and capable of adaptation to suit the requirements of the syllabus in innumerable and diverse schools and colleges, the enthusiasm for new and attractive teaching methods in a variety of subjects will die for lack of support.

Farm Study Scheme

Nowhere has the inclusion of agricultural material been so marked as in the teaching of geography: in fact, there has been a near revolution so far as teaching methods are concerned. To begin with, the importance of food production in a world with a rapidly growing population led, after the war, to a much greater interest in the sources of our food and in comparative studies of farming both at home and overseas. The farm also proved to be an admirable sample of a country or a region, yielding information of a real and living kind, not only on crops and animals but also on sociology, topo-

graphy, geology, climate and economics. At first a pioneer movement, the use of the farm, and its significance as a focus for study, has become a marked and definite trend.

As a result of these changes Britain's farms have been opening their gates and their fields increasingly to an altogether new type of visitor. Many of the farmers who receive these parties of teachers and students may not realize all the implications which lie behind the extension of the schoolroom to the farm. Many doubtless think that this is just another outing. Others may imagine that all these boys and girls want to work on the land. In actual fact, as we have just seen, the farm has now become a serious subject for study in colleges and schools of many levels, with imaginative teachers realizing that the geography, history or social science class can benefit just as much from a contact with the land as does the biology or rural science class.

In the sphere of farm visits, the National Farmers' Union has played a most effective part; and the Union in all its regions, together with individual education authorities, has done a very great deal to foster contacts between farmers and schools. Local adoptions, however, have their obvious limitations. Moreover teachers are anxious to get away from their own immediate neighbourhoods and compare their own with other farming types; even, in fact, to see what is happening on farms overseas. This was a problem posed by the new development in teaching. The Association of Agriculture, with its Farm Study Scheme, sought to provide an answer by preparing a series of illustrated text-books, each of which tells the story of a farm. The choice of farms is wide and ranges from the Highlands of Scotland to the wheatlands of Manitoba. In addition to the basic picture of the farm presented in the text-book, annual reports are provided which trace the development and policy of the farmer's operations as they change with the years. In other words, no farm stands still and farming must be presented as a flexible, dynamic activity.

The studies seem to have met a very definite need, and since the Scheme was launched six years ago we have, quite frankly, been amazed at its popularity. While we had always felt that agriculture was a fascinating subject to the layman no less than to the agriculturist, if only it was presented in an interesting and intelligible way, we had not fully realized the very real, and largely unsatisfied, interest that existed. If the agricultural industry has felt misunderstood, the fault lies, I suggest, not in the story of the industry itself, but in the fact that for too long the affairs of the land were wrapped in a technical mystery quite beyond the grasp of the man in the street.

Television: The Farming Year

It is greatly to the credit of Associated-Rediffusion, the independent television company, that it showed its awareness of the interest and appeal inherent in the countryside, by providing in its newly-established schools broadcasting service a feature called *The Farming Year*. This programme, with which the Association of Agriculture has been happy to collaborate as a technical adviser, portrays week by week the life and events surrounding a large mixed farm in the Midlands. *The Farming Year* has as its compère Mr. Denys Bullard, whose easy country style and authoritative approach

have done much to give prestige to the programme. Mr. Evan Davies and his wife, who have allowed their farm to be invaded by the television cameras, have proved not only natural and photogenic, but also first-class ambassadors of the farming community. The programme has succeeded in acquiring an authentic and down-to-earth flavour too rarely seen on film. The story has not flagged for topics, and when the more exciting operations such as harvesting, cultivations and ploughing had to give way to the less spectacular, but none the less necessary, jobs like hedging, ditching, potato lifting and gate-making, the camera and dialogue have continued to hold the viewer's interest. Television is still a controversial subject among educationists, and what place programmes such as this will ultimately secure is not for me to say. To include a farming series has, however, been a bold experiment. And by all accounts it has been as much appreciated by the adults as by the schoolchildren for whom it was designed.

Teachers' training colleges

Text-books, charts, maps, visits and television programmes are all very well, but much of their message will inevitably fall on barren ground if teachers themselves are ill-informed on their subject and unaware of its potentialities. While it has been our experience that success with agricultural material in general education is only really possible where a teacher has a genuine interest in, or even a connection with, the land, much can be done through lectures and conferences to guide those who may be struggling with an unfamiliar medium. It is for this reason that the Association of Agriculture attaches very great importance to its contacts with the teachers' training colleges. It is encouraging that most of these colleges, notably those in the London area, are now active participants in our Farm Study Scheme and that, in any one year, we welcome to our conferences some four or five hundred teachers. During 1957 we concentrated on the connection between geography and agriculture. How much the agriculturist and the geographer have in common becomes apparent at these meetings. Farm management may sound a subject fit only for expert ears; and yet I was present at a conference in Scotland when a well-known lecturer from Glasgow University held an audience of laymen spellbound for well over an hour while he analysed in detail the management problems which the farmer had to face in an age of technical development.

These remarks take no account of all that is being done in the specialist rural school where actual work on a farm forms part of the curriculum. Neither has it mentioned Young Farmers' Clubs, schemes of specialist training (such as the Apprenticeship Scheme), nor the effect which the Association's work may ultimately have on the recruit to agriculture. What I have tried to do is to show that there is a genuine interest in farming in quarters far removed from the land, and among people, young and old, who are never likely to tread a field or plough a furrow.

Our cover picture this month shows Sallyann Candler, aged 12, making an entry in her "follow-up" book after watching one of the programmes, *The Farming Year*, in Associated-Rediffusion's schools broadcasts. She is a pupil at Peterborough and St. Margaret's High School for Girls, Harrow, where these programmes are keenly followed.

Grass on Sea and Estuarine Banks

G. Pearson Hughes, B.Sc.

National Agricultural Advisory Service, Eastern Region

Firmly-rooted grass can help to keep a sea-bank tight, but it must be the right grass and properly maintained.

Along the coasts of Britain there are many areas of low-lying land protected from the sea by man-made earth-banks. A lot of these areas are of high agricultural importance, in that the farming systems practised are intensive and highly productive. Thus it is essential that these earth-banks should be durable. On many of the older banks, and where water erosion is not too severe, both the seaward and landward faces are covered with grass, and until the 1920s this grass was kept under control by the regular grazing of sheep. But in 1953 many of the banks went down before the disastrous sea flooding, so that miles of earth-banks have been and are being reconstructed. It is now common practice to face the seaward side of the bank with precast concrete blocks, either interlocking or sealing them with bitumen. Only the top and landward side is left in grass.

In the main there are two classes of earth-banks: those on which grasses of one kind or another are already established, and the newly-constructed banks that have not yet been sown. Established banks may have been grassed for some time, and even though originally sown with grasses of agricultural value, they quickly become colonized by couch (*Agropyron repens*) or sea couch (*A. pungens*), which are dominant on the majority of the banks. The grass usually sown is an early, stemmy, non-persistent strain of perennial ryegrass—*Lolium perenne*—which, if it becomes established at all, is quickly replaced by either of the species of couch mentioned. It is essential that the growth of such herbage should be controlled, and considerable progress has been made in devising machinery for cutting on these slopes. But in many instances only hand labour is available to deal with considerable lengths of banks and thus the herbage is either allowed to die back or is mown and left to rot on the face of the bank. In this way the bank gradually becomes covered with decaying vegetation in which the couch rhizomes become loosely rooted, as opposed to being firmly established in the soil of the bank. Under such conditions an unsuitable surface is formed which can easily be eroded, should high tides cause the sea to wash over the top. The grass on these banks needs to be kept under tighter control, either by grazing with sheep (in which case the couch would gradually be replaced by closer-growing turf-forming grasses), or by stricter supervision of cutting and the removal of the cut herbage from the bank to avoid the danger of an unstable mat of decaying vegetation.

Basic conditions

The banks now under construction are very largely made from the soil lying immediately behind them. This soil can vary in quality and texture

from sandy gravels to intractable clay, although in the main the soils concerned are clay or clay with silt. Most of the banks consist wholly of the soil at hand, but in a few cases they may be covered to a depth of 4–6 inches with a layer of imported top soil. Whatever the nature of the final surface, it will usually be short of the major plant foods—phosphate, potash and nitrogen—and if these are not supplied any grass that may be sown will have an extremely hard struggle for survival. And the moisture conditions of such a habitat are also extremely variable: at times the banks may dry out to considerable depths. This again makes seedling establishment extremely uncertain. The combination of these two factors, poor soil and variable moisture, often means that sooner or later none of the grasses sown survives and couch quickly takes over. True, there may then be the possibility of better control by cutting or grazing, but this may not be to the liking of the engineer because of the rooting habit of the couch and possible fissuring of the bank.

In the past it has been the practice to use grasses capable of establishment under unfavourable conditions, to overcome the difficulties of low soil fertility and the danger of the bank drying out after sowing. Perennial ryegrass is the commonest species used, and is of additional value on account of its ability to withstand a fair degree of salt in the soil. In spite of the work carried out in some areas on suitable seeds mixtures for sowing banks of this kind, little account is taken of the leafier strains of perennial ryegrass now available. The main criterion in the choice of seed still seems to be cheapness rather than its ability ultimately to form a close, dense turf such as S.23 pasture perennial ryegrass, for example, would produce. It is surprising also that in the majority of cases no compound fertilizers are given at seeding time to provide immediately available plant food: there is little doubt that if this were done, one of the factors responsible for poor establishment would be removed.

Planting out instead of seeding

The problem of drying out after seeding is very serious and difficult to overcome. The quicker establishment of the large-seeded perennial ryegrass again helps to conquer this difficulty but it does not always succeed. Direct sowing of this grass has excluded the possibility of using other, more valuable, turf-forming species; they are at a disadvantage in being small-seeded and unable to establish themselves from seeds under the conditions prevailing. Examples of these are S.50 timothy (*Phleum pratense*), smooth-stalked meadow-grass (*Poa pratensis*), bent (*Agrostis tenuis*) and S.59 creeping red fescue (*Festuca rubra*). Sown directly on the banks, these grasses would have little chance of survival because of soil condition and lack of moisture, whereas if they were first sown under nursery conditions, preferably in small pots, and then planted out as grown plants at 2 feet square intervals, they would soon spread over the bank. This method is, of course, infinitely more laborious than seeding direct, but it has several advantages: it leads more surely to a firm, close turf which will reduce fissuring of the bank to a minimum, it lessens shrinkage of the bank by keeping transpiration as low as possible and, finally, it produces a sward eminently suitable for sheep grazing and requiring a minimum of cutting should grazing be

impracticable. Even if this technique of grass planting is adopted, plant food in the form of fertilizers should be given when the bank is planted out.

Keeping a firm turf

Better ways of establishment must, however, be followed by better maintenance if the turf is to hold the bank in times of inundation and minimize bank shrinkage due to moisture loss. To this end, a firm turf with the minimum of leaf area capable of transpiration and drawing up moisture from below is desirable, and some system of keeping the grass in as close a condition as possible will be necessary. Theoretically this can be achieved by frequent close mowing or by sheep grazing, but neither of these is regarded as practicable in many situations at the moment. If, however, these expensively constructed walls are to be kept in good state of repair, proper maintenance will have to be undertaken in one way or another as time goes on.

Initially, therefore, attention must be paid to the establishment on new banks of good swards, by applying adequate fertilizer, choosing suitable grasses of the right strains and possibly adopting a planting technique rather than sowing direct. Later, as the bank herbage becomes established, it must be maintained by chemical weed control, fertilizer dressings, and regular cutting or grazing.

Some facts and figures on West German agriculture

Although West Germany is known principally for its industrial development, its agricultural record is nearly as remarkable. A little more than 35 million acres, or approximately 58 per cent of the total area of West Germany, are used for agriculture. About 21 million acres of this are arable land and the remaining 14 million are pasture. In 1957, agricultural production in West Germany was about 25 per cent above pre-war levels.

Grain production, particularly of rye and wheat, has increased sharply since the war, to offset the loss of rich grain-producing areas in the Soviet zone and the territories at present under Polish administration. Last year West German farms produced 3,843,000 tons of wheat, 3,816,000 tons of rye, 2,504,000 tons of barley and 2,228,000 tons of oats. There was a potato crop of 26,289,000 tons. Sugar beet acreage has nearly doubled in recent years, and in 1957 production reached 9,690,000 tons. Fodder beet production for the same period was 25,573,000 tons.

Animal products now take up a far larger share of total agricultural production than before the war. Last year there were more than 11 million cattle on West German farms, of which 5·5 million were milch cows. They produced milk at the rate of 8·1 kilogrammes (17·82 lb) per animal per day. During the same period the pig population reached 15 million, and the chicken count stood at 56 million.

Some crops already exceed domestic demand; since 1953 efforts have been focussed principally on improving quality and reducing cost. West Germany is the world's second-largest producer of apples, and last year had 90 million productive fruit trees of various kinds. The country is, however, a large importer of citrus fruits and fresh vegetables.

Many West German farmers are also landowners; only 12 per cent of the land under cultivation is leasehold. Of the 5 million people who are in agriculture—some 20 per cent of the working population—4,934,000 are farmers and their families, and 1,522,000 of them work part-time. Only 760,000 dependent workers are employed on West German farms. In the last twelve years over 70,000 expelled farmers have been resettled on farms of their own in West Germany. Farms are mostly small—over 60 per cent are of less than 50 acres.

Kenneth J. Cole

The Future of the Small Table Poultry Producer

JOHN HALLIWELL, N.D.P.

National Agricultural Advisory Service, Yorks and Lancs Region

WE have seen marked changes in the poultry industry in recent years, and nowhere have these been as sweeping as in the table poultry section. The word "broiler" has passed into everyday usage, after going through a hail of criticism. The days of the dual-purpose breeds and crosses are said to be numbered. Overproduction of turkeys, coupled with a marketing fiasco, depressed Christmas cockerel prices in 1956. What does it all mean? Is the day of the small producer over?

Farmers everywhere are asking questions like these. Any attempt to answer them must involve a good deal of prophecy, which is always risky and unrewarding, but let us look at the present position and possible trends. There is little doubt that the broiler industry will continue to expand for a good many years yet. It has been, and still is, a very profitable business for people with the necessary capital to invest in the costly houses and appliances. The difficulty of obtaining capital, in the face of credit squeezes and a high bank rate, may have slowed down expansion in the broiler industry, but I doubt whether it will stop it altogether. Capital is still going into the marketing side of the industry, and costly plucking and eviscerating plants are hardly likely to be established unless the birds are forthcoming.

Any large-scale expansion is likely to depend mainly on credit financing of the producer. This may seem an undesirable trend, but already there is talk of hatcheries and processing firms financing broiler projects.

Sideline production no longer worth while

There is no doubt that increased production will mean lower profit margins—some broilermen are talking in terms of 6*d*. or less per bird. This will mean larger units per man and, as I see it, a throughput of about 20,000 birds per year—or one 5,000 bird house—will be the profitable minimum.

All this holds a wealth of implication for the ordinary farmer, whether he has the slightest interest in broiler production or not. Once capital has been invested in the production and marketing of these vast numbers of birds, it will be very unlikely that we shall ever return to the position that existed four or five years ago. In other words, once production has increased, nothing short of a major economic upset or political policy can force it down again.

How far this tremendous increase in the production of chicken meat will affect beef, mutton, and pork producers is problematical. What is certain, however, is that they *will* be affected to some degree.

Broilers can also have a far-reaching effect on the surplus hen market. Size of carcass will no longer be an important economic factor, and the breeding of smaller-bodied egg-producing strains will gain added impetus.

The small sideline producer of table chickens is likely to be engulfed in the tidal wave of broilers. How can it be worth while to produce odd fifties, or even hundreds, if the profit is likely to be as low as 6*d*. per bird? It is doubtful if many of these producers make a reasonable profit even now.

Christmas cockerels can be considered separately. Many are reared on general farms in small batches of fifty or a hundred. They are out in the stubble fields for a considerable part of their life, and the resultant saving in food costs is largely responsible for the profits they make. Broilers are not large enough to compete directly with these birds at Christmas. Indirectly, however, a big increase in broiler production is likely to depress Christmas cockerel prices. To be economic, the cockerel producer will have to cut mortality rates and labour charges to a minimum. Also carcass appearance will become more important, which means that these stubble birds will have to be bred specifically for the table. More attention will have to be paid to food conversion, so that anything hatched earlier than June would be a doubtful proposition.

Turkeys an answer

What of turkeys? It seems probable that the days when turkey producers spent the weeks before Christmas frantically chasing dealers for an extra 1*d*. or 2*d*. per lb are nearly over. The price extremes of 1955 and 1956 are unlikely to be repeated. Instead, 1957 saw the first signs that producers are having to adopt more stable marketing methods.

The low prices of 1956 meant that uneconomic producers either stopped keeping turkeys altogether or decided to be extremely cautious when ordering future poults. But the efficient producer was not permanently affected by those events and, having little reason to fear the future, will continue to expand. Some of the latest figures from turkey trials indicate that there should be a worthwhile margin of profit for the producer, even with prices under 3*s*. per lb live weight. Admittedly, this applies only to stock from the better breeders, but the great difference in performance between their stock and that of the bulk of turkey breeders shows the improvement possible. There is tremendous scope for advance in the breeding of turkeys for earlier "finish", better egg production, food conversion rates, and hatchability.

What advice can be offered to the small producer? It seems that he will eventually have to abandon small-scale chicken production. He will have to streamline his Christmas cockerel production methods, but his stubble fields should still enable him to show a reasonable margin of profit there. Alternatively, he can go in for specialized broiler production, with all its current problems—sufficient capital, having the right houses, the right food, and the right chicks for the job; or he can try turkey production, which is slowly extending throughout the year in cut-up and pie forms, as well as in whole carcasses. Here his small-scale methods should not put him at a disadvantage against the big man. Indeed, provided he takes the trouble to get the best poults, houses them cheaply, feeds them as much home-grown cereals as possible, and sells them at the right age, he should be at an advantage, in that his labour charges and overheads may not be as high. He may also find it worth while to pluck and dress his own birds, and develop a retail trade.

Farming Cameo: Series 2

2. Builth, N. Brecon

W. Bowen Thomas
Assistant County Advisory Officer

The district lies some 18 miles north-west of the county town of Brecon. To reach it by the most direct route, you take the old drovers' road that winds its way through the rural hamlets of Lower and Upper Chapel, gradually ascending to the plateau of Eppynt range of hills. The road undulates through the virgin land, unfenced, and uninhabited except by the hardy sheep and wild birds that enjoy the solitude of the open spaces, on past the old Drovers Arms, its purpose long since gone. You travel on, absorbed in the silent vastness of the common grazings, along the seemingly unending road.

Suddenly it falls away to reveal a large pocket of small farms, nestling between your point of vantage and the beautiful River Wye, in the north of the district—a panorama of small fields, varying in size, shape and gradient, and broken by large, irregular-shaped tracts of common whose colour varies from green to brown with the advancing year. To the west, you see flat blocks of land of a different shade—pale cream, denoting an area of inadequate drainage, peat overlying clay and carrying a dominant herbage of molinia, a grass that contributes little to summer grazing or to winter keep. Behind the wet areas the dark green of the newly-planted pine forests is becoming increasingly evident, the plantations giving the impression of a well-regulated army invading the sheep lands. This advance is received with mixed feelings: on the one hand, there is the loss of the sheep grazings, but on the other there is the offer of employment and the reintroduction of people to the depopulated areas.

In the background, to the north, lie the Elan Valley hills—grassy slopes of unimproved herbage on which the hardy Welsh sheep spend their allotted span and magically keep within the bounds of their "walk" by instinct rooted in generations of habit.

Cradled away in the deep valleys and out of view is the large man-made reservoir—the watery grave unfortunately for several remote farmsteads, but which today provides the all-essential water to the Midland towns.

The rugged scene, while pleasing to the eye, is nevertheless a vast area of rough grazings, with a great potential of summer grazing for sheep, cattle and ponies, and a totally inadequate proportion of cultivable land to provide the winter food, which is, after all, the key to the stock-carrying capacity of any hill area.

The relationship between enclosed and unenclosed land is a very real problem, particularly when thick snow covers the hills for any long period of the already long winter, and sheep flocks have to be brought to the home-lands before the usual date.

The soil is derived from the acid, phosphate-deficient Silurian shale. It is as grey as the clouds which seem to form a constant roof over the area and thus limit the hours of sunshine. The lack of sunlight and the high rainfall govern the crops that can be grown and also the growth of the store cattle and sheep, which are the main and often the only source of farming revenue.

The sheep are Welsh, local in character, and have remained unchanged for a very long time. They vary in size according to the contour, the breeding being carefully planned to maintain the maximum hardiness. The small white-faced ewes graze the upper rim of the Elan Valley and, as one descends towards the market town of Builth, the facial character of the sheep changes from white to speckled and then to black.

The speckled Welsh are a hardy local breed centred on the village of Beulah. This type is the dominant breed of the "walks" of the district, and great strides have been made over recent years in fixing the type and improving the fleece quality. It has recently been decided to form a flock book of the breed.

The cattle are either small mixed flying herds of dairy cows, kept as a subsidiary enterprise to sheep, or Hereford or Hereford-cross cows mated with a Hereford bull, and kept to produce calves on the single-suckling system. The calves are sold either as weaned calves, as yearlings or three-half-year olds. The premium bull has played a vital part in the breeding policy. Small societies are dotted over the whole district, and it is easy to see the influence of these selected bulls reflected in the breeding and sale stock of the district.

The main cereal is oats—mainly for feeding, with a straw that gives maximum feeding value. Only a very small acreage is ever threshed, as the crop is usually fed on the "sprig". The variety S.221 has proved one of the best for the purpose and the locality. The rest of the arable is devoted to brassicas for grazing.

There is also a small nucleus of seed potato growers. This is a worthwhile crop and the most profitable per acre in the district, but expansion has been slow, due no doubt to the labour equipment of the crop and the fact that the farmers have not been accustomed to arable cash crops.

The people of the district are in direct contrast to their environment. They are kind, hospitable and, of necessity, thrifty—a thrift ingrained through years of hardship in extracting a meagre existence from the small uneconomic hill farms, and based on a philosophy that the only money that really matters is the money that they are obliged to spend. They are excellent stockmen and true sons of the soil. The traditional movement of the hill farmer down country during the past generations has left its mark. The men of pioneering instincts very often left to seek their fortunes in kinder climates. However, the war and its land hunger has partly closed the avenue of promotion and temporarily stopped the drift. Thus the enterprising hill man has been compelled to remain on the land of his birth, and this has brought about a significant change in the farming of the hill area.

The land has never been so well farmed nor the stock of such high quality, and gradually the area of rough grazing is being reclaimed, enabling more and even better stock to be carried. It is hoped that this expansion will ensure the well-deserved prosperity and the security of these people for generations to come.

Farming Affairs

Raising credit for long-term improvements

As we all know to our cost, investment capital is short these days. It is not only short in farming: it is short for everybody; and as a result, it is expensive to borrow. Therefore, the first question to ask yourself if you are thinking of raising money for a Farm Improvement Scheme is whether the outlay is really necessary. Can you do without it? Can you improvise instead? What will you gain from the improvement? Will it earn you 10 per cent net on the total outlay—not just on your two-thirds of it—or at least 25 per cent before allowing for interest and depreciation? When you have faced all these questions and slept on them, and still find after all that you cannot do without the improvement, and that you have got to borrow money to pay your two-thirds share towards it, then there are several choices open to you. It will depend on the circumstances, and the advice you get from your accountant, which you select.

The first course is to divert resources from current expenditure. This, quite simply, means borrowing from those with whom you do business—from your merchant, implement dealer, auctioneer, your co-operative society or any other party in the farming family. Will they allow you to delay paying your bills for a few months, and on what terms? Of course, they are not lending institutions. They are, none the less, generous and ready lenders as a rule, to clients who play fair with them. Goodness knows why: it is just a custom that has grown up, and one that most of us at one time or another have been grateful for.

Another way of raising money out of revenue expenditure is to use hire purchase. There is nothing immoral about it. Half the business done in farm machinery is done on deferred terms these days. So, if you need new equipment apart from the improvements you contemplate, you can, by deferring the capital payments on the equipment—the interest works out at about 12 per cent—release money, which would otherwise have been committed, for the improvements.

The second course is your bank manager. He's a worried man these days. He is under strict instructions from his head office to cut down overdrafts and not to increase the total volume of his lending, but he will be sympathetic to a well-thought-out case for a short-term loan on a Farm Improvement Scheme that makes business sense. If he falls for it, it will cost you 8 per cent.

The third course is to release your own working capital. If you are a landowner, or an owner-occupier, you can take out a mortgage. On the short term this is likely to cost you more than 8 per cent, because you will have valuation costs, stamp duty and other fees. Among the professional institutions are the Agricultural Mortgage Corporation and the Lands Improvement Company. The loan you negotiate with them will be secure over the period of the covenant. It will not be called in, and it could amount to as much as two-thirds of the safe value of your assets. The chief snag is that

interest and repayment instalments are fixed over a period of years. Consequently, if times change for the worse, you have still got the debt to discharge. At the moment, the Agricultural Mortgage Corporation rate is 7 per cent.

As a further alternative, you can take up a mortgage endowment loan with an insurance company. The annual payment is partly premium and partly loan interest. At the end of the term, the policy matures and repays the debt. If you die first, the policy becomes payable and passes debt free to your heirs.

Finally, you can, even if you are not the owner of your farm, consolidate your assets by forming yourself into a limited liability company, and use them in this way for securing short, medium or long-term loans. Tenant's capital can easily amount to £30 or £40 an acre these days, so that this is often the cheapest and most practical way of adding to your resources for development purposes.

Two last words of advice. Discuss your proposals with your accountant. He is the man best qualified to guide you. He should know your circumstances as well as, or better than, you do, and will know which course it is in your best interests to follow.

The other word is a comment on the scheme itself. It is excellent, generous and a recognition on the part of the Government that a lot of holdings need modernizing and equipping for the times ahead.

J. T. Beresford

With his partners, Mr. J. T. Beresford farms about 3,000 acres in Wiltshire and in Wales.

At the Farmers' Club

SOME FACTS AND FALLACIES ABOUT NEW ZEALAND GRASSLAND FARMING

"I believe the principles underlying New Zealand grassland philosophy and techniques are applicable in some degree to every grassland country," declared DR. C. P. MCKEEKAN, Director of Ruakura Animal Research Station, New Zealand, addressing the Farmers' Club on April 9. In a stimulating review he explained both how and why the New Zealand farming system works, correcting incidentally some commonly held fallacies.

Thus, he emphasized that practically all New Zealand pastures are permanent—a key factor in the New Zealand farming economy. Permanency permits high output per labour unit to be combined with low maintenance and capital costs. These permanent pastures are so flexible that remarkable increases in productivity are obtainable, at low cost, solely by fertilizer treatment, undersowing, and stock management. Renovation by ploughing and reseeding may occur only once in a lifetime.

In most districts of New Zealand, grass grows to some extent every month, but even in the most favoured grass-growing areas like the Waikato, there are from four to six weeks of virtually no growth each summer, and only token growth occurs during the two months of winter. Supplementary feeding of livestock is therefore a major preoccupation. Waikato dairy farmers regularly conserve some 40 per cent of their grass as silage and hay, lowland fat lamb producers provide hay and/or crops to supplement pasture deficiencies, and hill farmers grow crops where they can, or adopt special pasture-management techniques that permit the transfer of grass grown during the flush to periods when growth is virtually nil. This idea of transfer

is basic to the New Zealand philosophy of grassland farming. In nature the curve of pasture growth does not fit the curve of animal requirement, even in favoured New Zealand. Matching the two curves is therefore the main problem.

The New Zealand farmer adopts a realistic attitude towards his livestock, and accepts the need to punish both animal and pasture where necessary to achieve high yields per acre. The "controlled rotational grazing" practised in New Zealand is a flexible system. Fields are grazed when ready. Silage and hay are used to lengthen the grazing intervals when growth slows down in late autumn and winter; virtually the whole farm will be removed from the grazing cycle and the stock concentrated in a small area. Rotation of the complete farm grassland is also abandoned once the herd calves down in spring, when the "autumn saved" fields are strip grazed. The operator's judgment is the key factor.

Set stocking is usual on lowland fat lamb farms carrying four breeding ewes per acre, from lambing to weaning. But with six or more ewes per acre, rotational grazing is routine even during suckling, and after weaning, controlled rotational grazing is used for all lowland ewe flocks. Rotational movement is also adopted for hill flocks and, particularly where and when there is set stocking of sheep, controlled grazing by cattle is used to keep the sward in better order for the sheep.

Experiments with identical twins have proved that under New Zealand conditions, strip grazing has no advantage over intensive controlled rotational grazing, during the main period of grass growth; the law of diminishing returns operates. For dairy cows, although strip grazing permits better rationing than a paddock system, full feeding is extremely difficult to achieve except with highly palatable leys.

New Zealand farmers willingly overstock from the animal husbandry point of view, for both practice and experiment confirm that high stocking is of primary importance in efficient conversion of grass to animal products.

Dr. McMeekan discounted the idea that New Zealand cows had developed special ability to utilize grass more efficiently than cows bred in a "concentrate" environment, suggesting instead that under free grazing conditions small cows of Jersey origin would be expected to be more efficient at converting grass to milk than large ones, as intake of bulky feed is limited by rumen size.

Though New Zealand hill pastures are normally used for stock raising and wool production, and lowland pastures for meat and milk production, interchangeability is growing, especially since first-class pasture can be established even on steep hillsides. There are also opportunities for diversification should this become an economic necessity. The New Zealand farmer's reaction to falling prices on the U.K. market will be to increase production, for which the scope is still being extended by research and by practical performance. Above all, the New Zealand farmer will avoid subsidies.

Sylvia Laverton

Monthly beef cheque

Finishing beef is a lengthy process. Without finance for easing the burden of monthly outgoings, for stocking the land and for buying stores to ensure continuity of production, a change-over from dairying to beef is a difficult

enterprise. For many producers, the milk cheque has become a financial sheet-anchor.

In offering a monthly beef cheque, Fatstock Finance Ltd., a company set up in March by the N.F.U. Development Co. and the FMC, may have helped to solve the difficulty. Two credit schemes are offered at a simple interest rate of 10 per cent per annum. The first provides advances, paid in equal monthly instalments, towards the cost of feeding and husbanding beef cattle. Feed and labour costs can thus be paid for during production. The second scheme provides loans in lump sums up to 75 per cent of the total cost of buying stores.

Both schemes can operate throughout the year for periods of three to twelve months, repayment being made by deduction from returns on the sale of the animals, which must be sold through the FMC, the company's managing agent.

Fatstock Finance Ltd. has been set up by farmers for farmers. It is a self-help enterprise and allows the under-capitalized producer an alternative to milk. More important still, it is likely that the farmers' own concern will see to it that the loans made are agriculturally sound; in other words, that they increase productivity so as to be self-liquidating.

E. St. J. Height

Fatal accidents in agriculture, 1957: England and Wales

MACHINERY		BLOWS AND WOUNDS	7(1)
Tractors		FALLS	
(a) Overturned	31(4)	From platforms, ricks, stacks	1(1)
(b) Overturned—Silage heaps	1	From vehicles and trailers	9(1)
(c) Falls from	4(2)	Other falls	2
(d) Various	11(2)		12(2)
Implements and machines (including self-propelled)		OTHER CAUSES	
(a) Power take-off shaft	4	Burns and scalds (not involving machinery)	1
(b) Various	9(2)	MISCELLANEOUS	
Fixed and portable machinery (including power tools)	8	(a) Gunshot	4(1)
Lorries and cars	4(1)	(b) Lightning	1
Electricity	4		6(1)
	76(11)		
ANIMALS			
Bulls	6		
Other	5		
	11	TOTALS	112(15)

NOTE: Fatal accidents to children under 15 years are in brackets and included in the totals.

The Bath and West Show at Plymouth

The Bath and West Show this year is being held on May 28–31 at Central Park, Plymouth, on the border of Devon and Cornwall—an area where small farms predominate. For many years small farm units have been the backbone of this area; there are more than 30,000 agricultural holdings of over one acre in the two counties. Holdings of 50 acres or less comprise 60

per cent of all the holdings in the two counties, and 20 per cent are between 50 and 100.

Grass and livestock are the chief features, although horticulture is important in many coastal and valley areas. The Ministry's exhibit is accordingly designed to show how the small farm can make the most of its resources by getting maximum output at minimum cost.

The grassland exhibit concentrates upon methods of improving steep hillside fields (often they are more notable for their beauty than for their productivity!); also it stresses the importance of controlled grazing and the need to take early cuts of grass for silage so that fewer acres are left for the very risky kind of hay-making under the variable weather of the south-west.

Hand in hand with getting the maximum production from grass is the need to provide well-watered fields, and the experience of a Devon farmer who harnessed his own spring water supply is drawn upon.

Pigs are a major stock enterprise on many of the holdings in the area, and the lesson to be learned from the livestock exhibit is the need to increase efficiency by improving quality and decreasing costs. The quality aspect is demonstrated by a display of carcasses showing present-day market requirements.

Other points of interest are the need to reduce the losses of piglets (particularly in the first week of life), ways of adapting the traditional local barn for livestock rearing, the kind of equipment necessary to make a success of a poultry deep litter unit in the converted barn, and methods of controlling coccidiosis in deep litter.

The importance of healthy stocks in strawberry production and the necessity for careful packing and marketing of the fruit is the subject of another exhibit.

Combining business with pleasure will be facilitated if you arrange to meet your friends at the Ministry's stand (No. 406, Avenue J).

Forthcoming agricultural shows

Date	Show	Location
May 28–31	Bath and West	Plymouth
June 10–12	Three Counties	Malvern Hills
June 18–21	Royal Counties	Winchester
July 1–4	Royal Show	Bristol
July 8–10	Great Yorkshire	Harrogate
July 23–25	Royal Welsh	Bangor

These dates are subject to revision or even cancellation.

Horticultural machinery leaflets

A new series of leaflets dealing with horticultural machinery is being issued by the Ministry as a companion to the well-known range on farm machinery. The first of these, *Glasshouse Heating Systems*, has now been issued. It deals with the various heating systems available—hot water, steam, air and electrical—and shows how better growing conditions can be obtained by the more efficient use of fuels and labour. Single copies are obtainable free from the Ministry of Agriculture (Publications), Soho Square, London, W.1; extra copies can be bought from H.M. Stationery Office, P.O. Box 569, London, S.E.1, or through any bookseller, price 6*d*. (8*d*. by post).

A second leaflet, *Boilers for Nursery Use*, is in preparation.

In Brief

GILTS AND THEIR YOUNG

The reason why some pigs may savage their young is discussed by a veterinary correspondent in the April issue of *Pig Farming*. This attacking of piglets is more common among gilts than sows, and in those cases he suggests that it may be due to the gilt being frightened of her young. "Quite often a gilt will act as if she has little idea that the piglet is associated with her. She will leap to her feet as soon as each piglet is born, swing round upon it and, even if she does not attack it outright she will hover over it as if defending herself. It is also possible that farrowing is more painful in gilts and that any discomfort is associated with the newly-born piglet.

"That fear plays an important role is indicated by the emotional conflict that can often be observed in gilts after farrowing. They wish to nurse and mother their litter, yet they half-snap at the piglets as if to warn them. It is interesting, then, to observe how fearlessness on the part of the piglet can overcome the resistance of the gilt. Once one or two piglets have crawled over the gilt's snout and tried to suckle her mouth there may be no further trouble."

It is advisable to try and be present at all first farrowings, since one can never be certain how a gilt will behave.

COBALT AND CONNEMARA

The majority of the farms in Connemara are small and almost entirely in grass. Along the coastal strip and on the little inshore islands the grazing for cattle and sheep may be reasonably good, but its content of cobalt is often far below the nutritional level required for the stock. Thus two easily recognizable diseases are traditional in the area—emaciation of cattle grazing certain sand-blown pastures alongside the seashores, known locally as *galar truagha*, and emaciation of sheep on some areas of peatland, called "summer pine".

On the mountain grazings, comprising heather, sedges, mat grass and various bents and fescues, cobalt is also commonly deficient, although there are known "curative areas" to which the animals seem instinctively to find their way.

The most susceptible period for pining in lambs is shortly after they are separated from the ewes in August. Apart from drenches of cobalt given at weaning time and when the animals are brought off the hills for dipping, worming, shearing, etc., the dressing of grazing plots with a fertilizer in which cobalt sulphate (2 lb to the acre) has been well mixed appears to offer the best solution. The growth and quality of the pastures are improved and the animals can be relied upon to seek out the best pastures available to them. In this way, the grazing animals may obtain the amount of cobalt they need to keep them free from the diseases caused by lack of this element.

BULLFINCHES IN THE ORCHARD

Fruit growers in many districts, notably in parts of Kent and Sussex, have come to dread the season when bullfinches descend on their trees and bushes, especially gooseberry bushes, and strip them of buds. So severe have their depredations become that in certain areas, much to the distress of bird-lovers, the handsome bullfinch has had to be officially deprived of protection. Yet shooting—and some hundreds are shot every year—is a somewhat ineffective method of dealing with

them. So long as a bountiful supply of food exists, birds are likely to come from the surrounding countryside to feast on it, unless ways can be found of discouraging or deflecting them. Bullfinches like to nest in large overgrown hedges, so that any grower who neglects to keep his hedges within bounds is offering them hospitality. We now know, too, that they serve worst the rows near a hedge, and the damage might be reduced by planting the more vulnerable bushes and trees towards the middle of the orchard, and perhaps substituting fences for some hedges. Finally there is some reason to suppose that bullfinches prefer wild food, such as the gean or wild cherry and traveller's joy. No harm could be done by experimental planting of these in the neighbourhood of orchards.

The Countryman

PROTECTION AGAINST PEA MOTH

One of the greatest trials of the pea grower is the larva of the pea moth which, given the opportunity, will sadly reduce the value of his crop. The adult moth, not unlike the clothes moth and quite unobtrusive, can be seen from the end of May until August, but it is most prevalent in early July. No time is lost in laying eggs in the flowering crops, and the minute grubs which hatch in about eight days quickly find their way to the pods for a feeding period of some three to four weeks.

Apart from normal good husbandry practice and the assistance of certain predators, control rests on (1) early or very late sowing, to miss the moth's flight period, and (2) routine spraying with a DDT emulsion, diluted to contain ¼ per cent DDT, at the rate of 120-140 gallons per acre. Wettable DDT powders have also given promising results.

The time when the spraying is done is very important, for crops to be picked green, apply a single spraying 7-10 days after flowering starts; for harvesting dry, a second spraying 14 days after the first. DDT emulsion at the strength recommended may cause some damage to tender foliage, so it is wise to test out on a few plants first.

Incidentally, this year's *Pea Growing Handbook* has just been published. It can be obtained from the Pea Growing Research Organisation Ltd., price 2s. (by post 2s. 6d.)

QUEEN OF THE PLOUGH

Ploughing matches are not exclusive to men. Women are just as eligible to compete, and in some countries they have done so with outstanding success. On one occasion, in the British National Ploughing Match, a young lady very nearly won her way into the World Contest and became a National Championship runner-up on the referee's decision after having tied with the man who won. In the U.S.A. last year a mother competed in the National Match whilst her husband kept an eye on the children watching from the headland. Ploughing is popular with Irish girls, several of whom are regular competitors at Irish matches.

In Australia, the girls have decided to have a ploughing match all to themselves and have set about arranging an Australian Women's National Ploughing Championship Match as a distinct event from any others, but to be held as an additional feature at the first Australian National Ploughing Match—at Wangarrata on 23-24 May. The girls are proposing to use three-furrow ploughs, and the size of their test plots will be ¼ acre, about half the size of the plots in the World Contest.

A "Queen of the Plough" competition is to be run in conjunction with the actual ploughing, wherein marks are to be awarded to the girls for their appearance, clothes and cleanliness of tractor and plough. A prize of £50 and three cups for the winning State team of three girls are being offered.

Book Reviews

Britain: An Official Handbook (1958 Edition). H.M. Stationery Office. 21*s*.

As a race we are not given to extolling our national virtues and achievements: compared with some, we are almost inarticulate. Yet when our achievements are gathered together and recorded, as in this publication, they form a most impressive list to put before the world.

It should not be assumed, however, that the worth of this book lies solely in its propaganda value overseas. For crammed into its 500 or so pages is a wealth of information on virtually every aspect of life in the United Kingdom which it would not otherwise be possible to obtain without diligent search amongst masses of white papers and reference books. Clearly presented, well illustrated with excellent diagrams, maps and half-tones, the facts and figures which it provides on legislative changes, economic trends, industrial development and social behaviour are at the call of every student and teacher of home affairs.

First produced for reference use overseas and placed on general sale in 1954, this handbook has been steadily improved every year. The latest change—it is now published at the end of the year instead of in the spring—means that it can be much more up to date than previously, including, for example, the Budget statement of the year. This particular volume covers events up to September 1957.

The book is divided into fourteen main sections under headings such as "Government and Administration", "National Economy", "Industry", "Transport and Communications", "Trade", "Religion", and "Science and the Arts". Each section is then further sub-divided—as, for instance, "Industry", which is broken down into agriculture, fuel and power, building and contracting, etc. In consequence, each enterprise or activity has a definite, if restricted, section to itself.

The 23 pages given over to agriculture and horticulture offer a straightforward account of the land and its uses, together with the factors that have influenced those uses in recent years. Within this limited space the compilers have traced the trends and effects of Government policy, analysed our land tenure systems and marketing methods, and generally recorded in faithful detail all the facets and achievements of the industry in the post-war era.

We in agriculture have, of course, a good deal of which to be proud in the last decade. It is salutary to remember, however, as this book brings out, that we have not been treading the road of progress alone. Other industries, both great and small, have similar success stories of their own. In the chemical industry, for example, production is now running at two and a half times the pre-war level; our vehicle manufacturers go from strength to strength and make the largest single contribution to our export trade (£418 million in 1956). A little-known industry—the manufacture of office machinery—can now boast that their output is second only to that of the U.S., having reached £45 million in 1956. These are the things we tend to overlook by a too deep concentration on our own problems and needs.

The Handbook is thoughtfully rounded off with a bibliography of further reading on the subjects covered. Again, the range determines that the selection must be rather arbitrary, but even so it runs to 36 pages. Finally, there is an index which proved accurate under test.

L.W.T.

Control of Losses among Young Farm Animals. O.E.E.C., Paris. H.M. Stationery Office. 12*s*. (12*s*. 7*d*. by post).

While a certain amount of loss among young farm animals is, in the nature of things, inevitable, there is no doubt that much of the actual loss could be avoided by following the accepted principles of good husbandry. In Great Britain itself, mortality in calves has been found to be 5 per cent in some areas and twice that in others, while on individual farms it may be as high as 30 per cent.

To determine the nature and extent of these losses in the area of the O.E.E.C. and with a view to their reduction, the

Organization sponsored a survey of the problem through its European agency. The survey was the basis of a conference held in Stockholm in 1956, and attended by representatives of many European countries, including Great Britain and Ireland. This booklet, which is the report of the Conference, gives summaries of the discussions, conclusions and recommendations.

The main text is divided into six sections dealing with diseases due to pre-natal non-infectious ailments; infections acquired before or at birth; infectious diseases in early life; parasitic diseases; diseases due to digestive disorders and diseases in early life due to nutritional disorders, imbalances and deficiencies.

Obviously in a text of 189 pages it would not be possible to do more than touch on many of these subjects, nevertheless the last two sections should be particularly interesting and useful to those doing advisory work on farms as well as to farmers.

W.D.M.

Portrait of the Chilterns. ANNAN DICKSON. Hale. 18*s.*

Following the success of his earlier books *Chiltern Footpaths* and *County of the Thames,* Mr. Dickson has now given us *Portrait of the Chilterns,* which sets out a store of local knowledge gathered over the forty years since his banking career first brought him to the Chiltern Hills. This career entailed living in many parts of the Hills and it brought him into close contact with the varied aspects of local life, both agricultural and urban. It also gave him an intimate knowledge of the roads, lanes and paths which form a network over the Hills, and of the history of the places and great men of the area.

Easily accessible from London—a mere forty-five miles from the city centre—the region contains a surprising amount of unknown territory; remote and secluded valleys wind up into the hills, and beech woods with their golden autumn tints clothe many a hill-top and valley slope. It is among these alternating ridges and valleys that Mr. Dickson finds the blending of town and country pursuits; furniture making, light industry and paper making, farming, forestry and fruit growing, all meeting present-day requirements and existing peacefully together in surroundings of scenic beauty and historic interest.

The author's wanderings range from the bare downs of Dunstable to the dense woodlands at the Oxfordshire end of the Hills. In places the book may seem a catalogue of roads, lanes and footpaths, yet I think their inclusion is justified, for there is scarcely one which does not bring some new and intimate glimpse of the Hills. The variety of scene is never failing, in every change of weather and in every change of the year. The author has obviously seen it all.

The book, with its clear, bold type and excellent full-page photographs, is an invaluable guide to those who would know the Chilterns better; to those who live and work there, it throws a new light on everyday scenes.

R.A.S.

The Poultry Handbook (1st Edition). Poultry World Ltd. 32*s.* 6*d.*

This publication is indeed what it claims to be—a standard work of reference for the poultry industry. It will be found most useful by all connected with the industry in any way. The sub-division into five sections makes very quick reference easy for the busy man.

The first section contains clear and interesting articles which deal with every phase of poultry-keeping, and are written by well-known specialists in the top flight of writers on poultry subjects in this country. These articles are freely illustrated, with well-chosen photographs and diagrams which emphasize many of the important points in the text. The encyclopaedia explains every term likely to be met in the practical and scientific literature on poultry-keeping, and the reference section provides a wealth of statistics and information and details of all those organizations to which anyone in the industry might ever wish to refer.

A quick referenee to any particular product is made possible by the buyers' guide, which lists manufacturers and suppliers of items used on poultry farms under their various products. The last section of the book is a directory of addresses of the firms mentioned in the buyers' guide.

The Handbook will have a wide appeal as a unique and useful book of reference.

C.W.G.

The Lily Year Book, 1958.
The Rhododendron and Camellia Year Book, 1958.
The Royal Horticultural Society. 10*s.* each (11*s.* by post).

The 1958 Lily Year Book is dedicated to someone who has done much for British horticulture: Frank Kingdon Ward, who has added many plants to the gardens of the world.

The cultivation of lilies in a wide variety of situations is dealt with by garden owners in many parts of the world, and this half of the volume alone provides much useful information for the specialist and for those who would like to attempt to grow some of these plants for the first time.

The Year Book is not restricted to plants bearing the name of lily, but can evidently include any plant within the large family of *Liliaciae*. This year there is an account of a discussion which took place at a Lily Group meeting in London about the erythroniums. Accounts of similar discussion meetings are less successful, and one would think that the Society might find a more satisfactory way of recording the useful information contributed by those present than by these verbatim notes.

The Rhododendron and Camellia Year Book has a shorter history, being descended from a series of books first produced in 1917, by the then new and exclusive Rhododendron Society. Pride of place is given to two most interesting studies by an original member, and by the original and only secretary of this Rhododendron Society from its inception in 1915 to its final decease some five years ago. Limited to a very few members who were always among the foremost rhododendron experts of their day, the Society not only produced three volumes of notes in several parts, but what was more important, was responsible for the production of *The Species of Rhododendron*. This book, although now nearly thirty years out of date, is still a useful work of reference and was one of the earliest of the still uncompleted works classifying the innumerable species of this vast genus.

Following this historical study the Year Book then skims lightly round the world, describing the cultivation or exhibition of these two delightful evergreens in such diverse places as one of the smaller of the Western Isles of Scotland, on the north shore of the Solent, in California or Virginia, in New Zealand or Australia.

To anyone with a garden, small or large, who wishes to add something new and exotic to his collection of plants, one or other of these year-books can confidently be recommended.

F.W.S.

The Study of the Soil in the Field (4th edition). G. R. CLARKE. Oxford University Press. 35*s.*

In a congratulatory communication to Mr. G. R. Clarke, Sir John Russell draws attention to the fact that the average life of a book is about two years. The fact that this book is now celebrating its 21st anniversary is in itself sufficient testimony as to its worth to soil scientists and students alike.

To the author, the soil *in situ* is a living thing. The soil sample taken from its natural environment is "dead", and the simple chemical analysis of this sample drawn in an arbitrary manner is but a post mortem. Those of us who live for and by the soil are only too well aware of this contention; in fact we use chemical analyses merely as a guide to the possible solution of some specific deficiency problem. Often the result of such an analysis leaves us in an even greater state of confusion than we were before. So it is that we welcome the soil profile description as a field record of everything that the intelligent observer can see in the "site". It is claimed that only from the site characteristics can there be developed a rational utilization of the land. Perhaps one day the author will effect a happy marriage between the two—herein lies ample scope.

Soil scientists will remember the first edition rather as a field notebook, widely used as a basis for official surveys at home and abroad. It is noteworthy that this booklet was the first on field soil description to be written in the English language. As such it served an excellent purpose. Further, it familiarized the student with the fascinating nomenclature used by the pedologist.

From this relatively small beginning there has now emerged a fine book, from which it is not easy to select individual chapters for special praise or criticism. Perhaps worthy mention should be made of the paragraphs dealing with soil constitution, the use of air photographs for survey purposes and the identification of soil categories without access to the site

by the interpretation of air photographs. It would have made for easier translation of the photographs if the tracing paper used in the book had been a little less opaque.

Clarke was described by the late G. Milne as the "Gilbert White of Soil Science". The new edition fully justifies this observation.

A.W.L.

Sheep Husbandry and Diseases (3rd Edition). ALLAN FRASER and JOHN T. STAMP. Crosby Lockwood. 35*s*.

Because of its usefulness, previous editions of this book have rightly earned an assured but handy place on many a bookshelf. In describing the 3rd edition, one can and must go further than that, for while many new features have been introduced, all the good ones have been retained. Most fittingly the text is now in two parts: in the first, Dr. Fraser deals with husbandry; and in the second, Dr. Stamp has dealt comprehensively with diseases. Another improvement is the increased number of references; these have now been put at the end of each chapter, and will prove invaluable for the research reader and the student.

In the husbandry section, Dr. Fraser has replaced chapter 6 with two new ones in which sheep farming is considered as a whole, letting each phase fall naturally into place. One of these chapters deals with the hill sheep and the other with the lowland; both are obviously based on personal experience and years of critical observation which bring out a reality that few readers will fail to capture. As in previous editions, the other chapters fully cover breeds, breeding, production and nutrition, and all, where necessary, have been brought up to date.

Dr. Stamp has contributed a wealth of information on the various factors that "interfere with good health" and gives a general understanding of disease. He has suitably grouped the diseases under four chapters. In so doing he has emphasized the part that errors in management can play, and also the need for accurate diagnosis before embarking on expensive treatment.

In all, here we have a book that in both sections is based on good practical facts expertly written. It has no substitute and can cater for the needs of all—laird, farmer, shepherd, farming student or naturalist—who genuinely want to know more about sheep.

J.W-L.

Soil. The Year Book of Agriculture, 1957. United States Department of Agriculture. $2.25.

For the past twenty years the United States *Year Books of Agriculture* have taken the form of massive surveys of particular branches of the subject. The first volume dealing with soil appeared in 1938 under the name of *Soils and Men*, at a time when the country was waking up to the dangers of soil erosion. Consequently soil conservation was one of the main subjects dealt with. The basic theme of the present volume is soil management, which is taken to cover all operations such as drainage, irrigation, liming, manuring, cultivation and cropping systems. Almost half of the book is devoted to sections dealing with soil management in regional agriculture, and the growth of special crops.

The first nine chapters deal with general principles; soil formation and the basis of classification, soil moisture, physical properties and soil acidity. Then follow nine useful chapters setting out the relationships of each of the major and minor elements to soil fertility.

The sections of the Year Book which will probably be of most interest to English readers deal with developments in the United States fertilizer industry. Some striking figures are given. The consumption of the three primary nutrients N, P, and K showed an almost fourfold increase in the period 1939–55. Organic manures, which provided about 90 per cent of the nitrogen applied at the beginning of the century, accounted for only 1·5 per cent of the nitrogen used in 1955. Liquid fertilizers, used chiefly in small scale horticulture in this country, are big business in the United States; thus anhydrous ammonia (containing 82 per cent N) accounted for about one quarter of all the "straight" nitrogen applied. Other sources of nitrogen in liquid form, such as aqueous ammonia with or without urea or ammonium nitrate in solution, were also used in substantial quantities. In a large country where transport is a major

cost, the tendency is naturally towards ever more concentrated materials, whose very purity sometimes exludes those minor nutrients that can make all the difference to crops in special districts. A final chapter on the research services gives a brief history of the development of field studies in the United States, starting with the first fertilizer experiments at Pennsylvania in 1882, and contains an impressive list of State Experimental Stations and Federal Field Stations where work on soil management is in progress. There is a glossary of technical terms, and a good index.

H.V.G.

Investigation of Virus Diseases of Brassica Crops. (A.R.C. Report Series No. 14). L. BROADBENT. Cambridge University Press. 15*s*.

For five years, Dr. Broadbent and a large number of collaborators have carried out intensive research into factors governing the severity and spread of the important diseases caused by cauliflower mosaic and cabbage black ring spot viruses. The influence of some of these factors was investigated by making repeat experiments in widely-separated parts of the country, thus increasing the value of any generalization from results. *Investigation of Virus Diseases of Brassica Crops* gives a detailed account of this research.

The emphasis throughout the investigation was on control, although Dr. Broadbent points out that control of virus diseases remains largely a question of applying common sense, and no completely novel measures are offered. However, the effectiveness of measures advocated in the past for use with brassica or other crops was assessed experimentally, and occasionally the information collected suggested a new line of approach.

It is heartening to learn that commercial varieties of cauliflower were found to differ both in the readiness with which they became infected and in the severity of the symptoms displayed after infection; this gives the hope that varieties with increased resistance or tolerance may be bred for use in the future. Useful information, other than that concerned with virus infection, comes from some of the experiments. We learn, for instance, that barrier-protected cauliflower seedbeds yielded not only a smaller percentage of virus-infected plants than did unprotected beds, but also a higher percentage of usable ones. Again, providing cauliflower plants with a high level of nitrogen increased the incidence of both cauliflower mosaic and the disorder known as "scorch".

Although a large amount of experimental detail has been included, the layout is such that the book remains very readable. It contains a combination of original observation and reference to the published work of others, and will undoubtedly be of great service to those requiring an up-to-date and full account of the virus diseases of brassicas.

J.H.H.

Rural Wales: A Yearbook of Welsh Agricultural Co-operation. Number V —1957. Welsh Agricultural Organisation Society, Ltd. 3*s*. 6*d*.

The one hundred pages of this Year Book give a clear and comprehensive report of the position of agricultural co-operation in Wales for the years 1954–55 and 1955–56. Unfortunately there seems to be no reference to the opening and closing dates of these two years.

The report of the Executive Committee for 1954–55 begins by referring to the loss of much of the 1954 harvest owing to bad weather, and records the willing help given by farmers more fortunately situated in giving supplies of hay and straw to those in need, and mentioning, too, the role played by the co-operative societies in this emergency.

In the opening paragraphs of the Executive's report for 1955–56 the statement is made that there is a tendency for costs of production of farm commodities to rise more rapidly than the selling prices of such commodities, a tendency with which most agricultural economists would agree. There is indeed a real note of pessimism in these paragraphs.

The problem of the small farm, which is attracting attention in several quarters, is rightly stated to be a question of very great importance in Wales, because it is a country of small farms and small businesses. Some of the statements, doubtless made out of consideration for the small farmer, are rather too sympathetic; it can hardly be said for instance that "their

position today is the result of nearly two decades of squeeze".

In general, however, the Report states that the Welsh co-operative societies experienced a good year and made significant progress. It is estimated that by making use of their societies Welsh farmers have saved or earned about £500,000. Emphasis is also laid not merely upon the volume of trade, but upon the role of the societies in providing their members with up-to-date knowledge and technical advice in methods of cultivation, and in raising efficiency as far as possible.

C.V.D.

A Study of the Economic Aspects of Christmas Turkey Rearing, 1955 and 1956. W. DYFRI JONES. University College of Wales. 2*s.* 6*d.*

Professor Jones's cyclostyled study covers two key years in the development of the British turkey industry, in which production really got into full swing. Expansion was so rapid that many problems were created. The climax came at Christmas 1956, when prices fell dramatically and in many cases returns to producers were disastrous.

It was commonly assumed that the low prices would force many small producers out of the industry, but the study showed that this need not be the case. In 1956 it was the largest flocks that suffered the heaviest loss, while, on the whole, the smallest flocks gave the best profit in both years.

The underlying reason for the heavy fall in prices in 1956 was the 70 per cent increase in numbers over 1955, but marketing also played an important role. According to Professor Jones, the dumping of large numbers of very low quality, badly killed or plucked, unpacked and ungraded birds on the market undoubtedly contributed to the lowering of prices.

The report emphasizes that at one time turkeys were considered tricky birds to rear. However, there is now a growing confidence in turkeys, either as a specialist enterprise or as a useful adjunct to other farming enterprises. This is due to modern methods of housing, particularly the development of straw-yards, to the use of drugs and to a better understanding of the feeding of turkeys.

The relative importance of the costs of production are dealt with. Food accounts for about 66 per cent of the rearing cost, the poult for about 25 per cent, while labour amounts to only 5 to 6 per cent. The conclusion is reached that the best killing age for the turkeys under review was 23 weeks, but as the average age of the birds killed was 27 weeks they were too old to ensure the maximum profit. The report establishes that it is generally more profitable to purchase day-old birds rather than growing turkeys of 8 weeks of age and upwards.

R.F.

British Agriculture. G. P. HIRSCH and K. E. HUNT. National Federation of Young Farmers' Clubs. 3*s.* 6*d.*

In *British Agriculture* Hirsch and Hunt have attempted to provide a simple, brief, but comprehensive account of the structure and organization of our farming. To be concise, and yet comprehensive, cannot have been easy, and the authors are to be congratulated on the extent of their success.

Having recognized the importance of environmental factors, discussion centres first on the farmer, and on the land, labour and capital which he employs in production. It then turns logically to a consideration of marketing, administration, and of the educational, research and advisory facilities which are available to the industry. The discussion concludes with an appraisal of the profitability of agriculture to landlord, tenant and farm worker, and to the nation as a whole.

Either as a simple account for the general reader, or as an introduction to further reading, this is an admirable little book. It is packed with facts and figures and provides a convenient source of much useful information.

A few quite difficult concepts such as income elasticity of demand and the terms of trade are not ignored, but are explained in the simple manner used throughout the book.

Of the many diagrams which are included in this book, the majority are clear and informative, but in a few cases the information they contain would have been better presented in some other way.

G.H.B.

Guild of Agricultural Journalists Year Book, 1958. Edited by GRAHAM CHERRY. Published by the Graham Cherry Organisation, Eagle House, Jermyn Street, London, S.W.1.

Agricultural journalists have had a Guild of their own since the last world war, and this year for the first time they have published a year book. In addition to matters of domestic interest to Guild members—their names and professional interests are listed—the book contains forty pages of agricultural reference material, not readily available in such a convenient form anywhere else.

Besides a summary of agricultural research now in progress at British universities, there are tables of useful statistical information arranged to indicate changes and trends during the past decade. Figures relate to output and uses of crops, livestock, milk, meat and wool; also to manpower, earnings, income, capital, machinery and farm supplies.

Since this section makes the Year Book a valuable reference source to others, besides writers, whose work is concerned with farming, a limited number of copies (price one guinea) are being made available outside Guild membership. The Guild is to be congratulated on this venture. It should help materially in promoting a better understanding, by the consuming public, of the problems of home food production—a matter of concern to every farmer in the country.

S.L.

Shell Guide to Trees and Shrubs. Phœnix House. 7*s.* 6*d.*

To the success of their three earlier Guides, Shell have added yet another—the trees and shrubs of the countryside, as seen through the march of the seasons. A two-page spread for each month presents a keyed coloured plate, delightfully composed by Mr. S. R. Badmin, and a well-phrased and informative complementary text by Geoffrey Grigson. Merely to turn the pages of this book idly, is to be impressed at once by the sylvan wealth of our landscape which awaits the seeing eye and the inquiring mind. It is, in short, a first-class simple guide which a great many people in town and country alike, will be glad to see—or, rather, *possess*. A special word of congratulation must go to the publishers for their excellent presentation at such a low price.

E.D.

Books Received

Applications of Atomic Science in Agriculture and Food. O.E.E.C., Paris. H.M. Stationery Office, London. 6*s.* 6*d.* (7*s.* by post).

The Agricultural Notebook (13th Edition). Primrose McConnell. Edited by Professor H. Ian Moore. Farmer and Stock-Breeder. 40*s.*

The Advancement of Science. Volume XIV, No. 56, March 1958. The British Association for the Advancement of Science. 7*s.* 6*d.*

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE by Billing and Sons Limited, Guildford and London.

"Sixteen stalwart pillars"

THE MARKET HALL at Ledbury in Herefordshire has stood upon "Sixteen stalwart pillars of sweet chestnut wood" since 1633. Of timber framing with a mellow tiled roof, it is said to be by John Abel, who built a similar hall (now demolished) at Hereford. Ledbury market was once held on Sundays, and its tolls were assigned to the relief of the town poor. Market day is now Tuesday.

ICI

FOR AGRICULTURE

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